ELECTRICAL REVIEW

and WESTERN ELECTRICIAN with which is consolidated ELECTROCRAFT

VOL. LXII, No. 22. CHICAGO, SATURDAY, MAY 31, 1913. ISSUED WEEKLY.

COMPRISING

ELECTRICAL REVIEW WESTERN ELECTRICIAN ELECTROCRAFT

ELECTRICAL REVIEW PUBLISHING COMPANY
608 SOUTH DEARBORN STREET
CHICAGO

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SUBSCRIPTIONS.

One Year, United States.....$3.00
One Year, Canada..... 4.00
One Year, Foreign Countries..... 6.00
Single Copy, 10 cents. Back numbers, beyond one month, each .25

Entered as second-class matter, November 7, 1908, at the Post Office at Chicago, Ill., under the Act of March 3, 1879.

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THE CHICAGO CONVENTION OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

Since the city of Chicago last welcomed the National Electric Light Association, there has been a very great increase in the numerical strength of the membership, in the work accomplished through the various standing and special committees, and, incidentally, there has been a great development in the investment and operating features of the central-station industry.

The National Electric Light Association represents in aggregate the best elements of leadership and promise in the engineering, mechanical, operative, commercial and financial phases of the generation and utilization of electrical energy. It is fitting that the thirty-sixth convention should be held in the city of Chicago, where central-station development, under the leadership of Mr. Insull, has seen its greatest accomplishments. Here is a great city growing by leaps and bounds, with a generating capacity and a network of distribution keeping pace with the growth of the city and its requirements for service. Here is a city of two and a half million people who are not only familiar to a great degree with the utilization of electrical energy and the adaptation of current-consuming devices, but in so satisfactory a manner has this service been rendered to them that they are active partisans of the corporation and have for it the most friendly spirit.

In keeping with the proportions and significance of the occasion we present in this issue a description of the system of the Commonwealth Edison Company, together with a special plate illustrating some of the conspicuous features of its physical development. On other pages we present an analysis of an ideal new-business department by Mr. Callahan, and Mr. Knowlton has contributed a running commentary on opportunities for central-station development. A notable contribution to the literature and information on the subject is the 32-page section devoted to data sheets giving comprehensive information respecting central-station service for industrial power requirements. An interesting commentary on present-day developments may be found in the article dealing with the establishment of public-service commissions, the personnel of their organizations and the tendencies of state regulation. This article is supplemented by a shaded-area map of the United States which indicates at a glance where commissions have already been established.

As a whole and in detail we have aimed to present upon this occasion a souvenir edition that would be practical in its every element. Every contribution has been prepared by a master of his subject and represents as nearly as we can arrive at it an accurate reflection of what we are all striving for in the industry today—the development of the commercial side of central-station work, the merchandising and utilizing of current-consuming devices, and the familiarizing of the public and operator alike with every opportunity, either present or potential, for "doing it electrically."

INCREASING THE EFFICIENCY OF THE ELECTRIC-PLEASURE-CAR CAMPAIGN.

At the convention of electric-vehicle interests in Boston last week an able paper was presented by Mr. E. R. Davenport, of Providence, R. I., in which the author voiced a number of constructive criticisms of the electric-pleasure-car campaign methods now in vogue, and emphasized in no uncertain terms the need of following the purchaser closely in his use of his battery-driven equipment, to insure his getting better service from his investment and incidentally to pave the way for the greater popularization of this type of automobile. The paper struck fire at the outset by a vigorous recommendation on behalf of lowering the prices of electric pleasure cars for the purpose of multiplying the volume of sales, a parallel being drawn between the work of Henry Ford in the gasoline car field and the present methods of electric-car production and sale. Without criticising the existing prices of electrics, doubtless relatively high on account of the cost of developing this infant industry, there is no question that if a $1,250 electric runabout of good construction could be placed on the market at present, it would stimulate sales beyond present ideas of rapid development, and would give the low-priced gasoline machine a very hard run for its money. Mr. Davenport claimed with no little truth that the modern electric vehicle is largely an assembled product, and with battery prices ranging around $450 to $500, and motors not much exceeding $115, there would seem to be something in his hint that if luxurious furnishings are omitted and selling expenses reduced, there is a chance for some enterprise to be rewarded in this direction.

Apart from the question of initial cost, however, that of real service to the purchaser is paramount in importance. Much has been made of the simplicity of the electric pleasure car, and with reason, but in actual use it demands some care and some scientific oversight which the average owner cannot provide unless he finds an unusually good garage and has a substantial bank account. Mr. Davenport spoke from the standpoint of the central-station man who has had to spend an undue amount of time and money in adjusting the equipment and practice of the vehicle user along lines for which the vehicle manufacturer and his agent are primarily responsible, and in presenting the paper and setting constructive criticisms before his audience, he performed a real service to the industry in general.

Among the points brought out were the desirability of giving the purchaser a closer idea of the mileage capabilities of cars, more technical data in the possession of vehicle salesmen, providing the vehicle user with all customary guarantees, informing him as to the auxiliary apparatus, hydrometers, syringes, and all minor incidental equipment whose use helps to secure the best service, and being ready to make good defective parts within a reasonable time without putting the onus upon the central station. The paper recognized the merits of co-operation, and suggested the assembling of representatives of central stations and of vehicle manufacturers to agree more definitely on the responsibilities of each toward the vehicle owner. There is no question that conferences toward these ends would accomplish much good in the present stage of the industry, and would tend to increase the existing rapid rate of popularization of the electric pleasure automobile.

AN IMPORTANT PATENT DECISION.

The Supreme Court of the United States on Monday last handed down a decision involving the rights of a patentee which is of great importance and on its face appears to be revolutionary in the sense of changing what has been regarded as an established point of law in this connection. Over a year ago in the case of Henry vs. Dick, commonly referred to as the Mimeograph Case, the same court upheld the legality of license provisions connected with the use of a patented article, even though the license provision had to do with the manner in which the patented article should be used after it was sold by the owner of the patent and the title vested in another party. This was the first time that such a case had been decided by the Supreme Court and the decision was taken as establishing the doctrine of contributory infringement as well as the right of the owner of a patent to include in a license for its use any provision he might see fit which did not contravene existing statutes or public policy, even though that decision was handed down by a divided bench.

As noted on page 1,088, the Supreme Court has, in the case decided this week, ruled that the retailer of a patented article is not limited by a license restriction which was imposed by the owner of the patent upon the purchaser of it. The exact significance of this decision is somewhat obscured by the particular circumstances involved in this case, for the retailer who was the defendant in this suit did not purchase the patented article directly from the owner of the patent. It may not be safe to assume that the decision would have been the same if the patented article had not passed through intermediate hands. This may be a vital point in the case; but if it is not, the decision establishes the principle that the resale price of a patented article cannot be controlled by the owner of the patent, since the courts will not enforce a license condition to that effect.

An important and interesting feature of the two decisions here mentioned is that the interpretation of the law depends so utterly upon the personal opinion of a few men, or, indeed we may say upon a single man. At the time the mimeograph case was decided there were but seven judges sitting upon the Supreme Court bench and that case was decided by a vote of four to three, the judges rendering the decision being Justices Lurton, McKenna, Holmes and Van Devanter. Justices White, Hughes and Lamar dissented. In the present case the decision is given by a divided court of nine members, the vote being five to four, and it is significant that the four judges who rendered the previous opinion now constitute the dissenting minority. Justices Day and Pitney were sitting in the present case and they joined with Judges White, Hughes and Lamar in giving the majority decision. This would seem to indicate that if the present court had decided the Mimeograph Case, it would have been decided differently.

The individual influence of Justice Lurton is particularly notable in determining the interpretation of our patent law. He was on the bench which first decided in 1896 that failure to comply with a license notice attached to the patented article constituted infringement. This was in the Button Fastener case. Other courts followed this precedent, which was never firmly established, however, up to the time of the Mimeograph Case, because the Supreme Court had not passed upon it. In that case Justice Lurton, who had meanwhile been appointed to the Supreme Court, wrote the majority opinion, referring to the precedents set up in the district courts by himself and others.

It looks now as if this principle could not be regarded as settled even yet, since with the present constitution of the Supreme Court the principle laid down in the Mimeograph Case seems liable to reversal.

STEPHEN DUDLEY FIELD.

In the last issue of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, we noted the passing of Stephen Dudley Field. Mr. Field was a notable character and contributed very materially to the development of the electrical industry. As an inventor he was versatile indeed and the products of his brain have found commercial applications all over the world. Mr. Field has been called the father of the electric railway, and it is a fact that he was one of the earliest of that group of inventors who practically at the same time conceived the idea of a motor-driven transportation equipment and made so brilliant a beginning in this great development a little over a quarter of a century ago. It is unfortunate that while Mr. Field's inventions are in practical use today in many forms of industry, and they are familiar sights all over the world, none bear a direct relation to him insofar as the use of his name is concerned.

TRIMMING TREES.

Much dissatisfaction is often provoked in residential districts where distribution lines are run overhead by the necessity which commonly arises of trimming off the branches of trees which would otherwise come in contact with the wires. Occasionally unnecessary trimming is done by an inconsiderate lineman, but in most cases the removal of the offending branches is a necessary requisite for a satisfactory job.

The necessary evil of thus marring the beauty of shade trees along residential thoroughfares would probably provoke less opposition if care were taken to do as little damage as possible to the trees. This involves not only restricting the removal of branches to those portions of the tree which are actually in the way, but also the use of approved methods in cutting off branches. Trees are sometimes permanently injured by haphazard methods of pruning, and not only is the disfiguration sometimes worse than it should be, but the way is often opened for the initial rotting, which in time may destroy the entire tree. Elementary instruction in the rudiments of trimming trees should be given to the foreman in charge of a gang of men, and if the central-station manager is not familiar enough with the subject to give this instruction himself, it could no doubt be very easily supplied by some horticulturalist or landscape gardener in the neighborhood.

Some of these elementary essentials may be mentioned here. In the first place, in cutting off a large branch, care should be taken not to strip the bark or wood back of the point where the cut is made. This can best be done by first sawing the under side of the limb part way through and then starting a cut from the top surface a trifle further out on the limb. To make the best job of it, a smooth finishing cut across the limb should be made after the first rough cut is completed and the branch is down. When the entire branch is removed, it should be cut off flush and smooth with the trunk of the tree. When cut near the fork of any branch, it is best to cut similarly flush and close to the other branch. This leaves the limb in the best condition for healing the wound. Unless properly healed, such a cut usually provides an entering wedge for the bacteria or fungus growths, which will eventually lead to rot in the heart of the tree or branch. The best protection is afforded when the cut surface is painted over with ordinary white-lead paint, to prevent such lodgment during the period of healing.

That portion of the population which takes an interest in shade trees (and nearly every householder does) will be greatly pleased to see linemen taking some care to do just as little damage as possible when trimming trees, and consideration of the general interests of the community in such small matters as this will do a great deal in establishing friendly relations and good will.

Supreme Court Decision Prohibits Fixing Resale Prices.

The United States Supreme Court handed down a decision on May 26 in the case instituted by Bauer & Company to force a Washington drug merchant to retail Sanatogen, a patented article, at a price stipulated by the manufacturer. The court holds that price cutting is not a patent infringement when the manufacturer has sold the article outright and surrendered the title to it.

The decision was rendered by a divided court, four of the justices dissenting. These were Justices Lurton, McKenna, Holmes and Van Devanter.

"The real question," says the majority opinion, "is whether in the exclusive right secured by the statute to 'vend' a patented article there is included the right, by notice, to dictate the price at which subsequent sales of the article may be made. The patentee relies solely upon the notice quoted to control future prices in the resale by a purchaser of an article said to be of great utility and highly desirable for general use. The appellee and the jobbers, from whom he purchased, were neither the agents nor the licensees of the patentee.

"Upon such facts as are now presented we think the right to vend secured in the patent statute is not distinguishable from the right of vending given in the copyright act. In both instances it was the intention of Congress to secure an exclusive right to sell, and there is no grant of privilege to keep up prices and prevent competition by notices restricting the price at which the article may be resold.

"The right to vend conferred by the patent law has been exercised, and the added restriction is beyond the protection and purpose of the act. This being so, the case is brought within that line of cases in which this court from the beginning has held that a patentee who has parted with a patented machine by passing title to a purchaser has placed the article beyond the limits of the monopoly secured by the patent act."

New Hampshire Legislation.

The Legislature of New Hampshire, which adjourned May 22, enacted the following bills, during the session, relating to electrical matters: Authorizing the Dublin Electrical Company to transfer its properties; enabling the town of Rollinsford to operate an electric light and power business; amending the charter of the Nashua and Hollis Electric Railroad; incorporating the Pioneer Electric Company; authorizing municipalities to acquire, maintain and manage lighting systems; amending the law authorizing the town of Antrim to establish an electric light and power plant; defining the powers of the Keene Gas and Electric Company.

Joint Meeting of Chicago Electric Club and Jovians.

On May 22 a joint meeting was held in the Hotel Sherman, Chicago, Ill., of the Electric Club and the local chapter of the Jovian Order.

Charles F. Hatfield, field secretary of the Panama-Pacific International Exposition, spoke briefly of the preparations for the exposition.

Eugene A. Rummler then introduced Charles S. Cutting, judge of the Probate Court of Cook County, who made an address on the subject "Judicial Efficiency," which was warmly applauded and resulted in the passage of a resolution placing the Club on record as opposed to political party designations upon ballots used in the election of judges.

Announcement was made by the committee having in charge the special entertainment for the National Electric Light Association that there would be a repetition of the circus performance staged by the Commonwealth Edison Company Section of the National Electric Light Association, at Medinah Temple, on the evening of Tuesday, June 3. All members of the National Association and of the Electric Club will be invited to this performance.

At a meeting of the Club on May 15 the ladies were present and an excellent entertainment was given. Donald M. Carter welcomed the ladies and Frederick P. Vose made an address.

May Meeting of Philadelphia Section.

The Philadelphia Section of the Illuminating Engineering Society held its regular meeting on May 16 at the Franklin Institute, with an attendance of 60 members and guests.

There was a large exhibition of gas and electric lamps equipped with residential glassware. The exhibits were described by Messrs. Snyder and Mansfield. Two papers were presented. The first was by Herbert E. Ives on "Some Home Experiments in Illumination from Large Light Sources." The second was by C. A. Peterson, entitled "The Design of Combination Fixtures." The papers were illustrated with models and lantern slides. The discussion was participated in by Messrs. Hoadley, Rowland, Bond, Ely, Lloyd, Mansfield, Pierce and Ferree.

Mr. Israel, chairman of the Entertainment Committee, announced a joint outing with the local section of the American Institute of Electrical Engineers on the afternoon of June 7.

Meeting of United Electric Employees.

The Association of Employees of the United Electric Light & Power Company, New York City, held a meeting on the evening of May 22. This was the official opening of the auditorium in the new substation on West 187th Street, which has been provided by the company for the use of its employees. There were over 400 persons present.

George B. Cortelyou, a director of the company, made a short address and was followed by Frank W. Smith, vice-president, who gave an illustrated historical talk entitled "Our Company." Mr. Smith has been associated with the company from its birth and presented some very interesting reminiscences of the early days. The lantern slides included photographs of the early overhead system of distribution, types of the first arc lamps in use, some of the first power stations, and one of the first Weston dynamos, which was installed on a Pennsylvania Railroad ferry boat 33 years ago. Another view showed this machine in operation in the Jerey City terminal at the present time. Curves and tables illustrating the Company's business growth were shown, as well as photographs of the $6,000,000 generating plant in course of erection on the Harlem River. The scope of the company's operations is indicated by the fact that $3,500,000 is being invested this year on capital account.

All-Electric School in Boston.

The school department of Boston is to inaugurate a school of practical arts, in the Roxbury district, in which electric apparatus and appliances will have a conspicuous part. A house which adjoins the new school building is being remodeled and made into an "all-electrical" school of home-making. Basement, laundry, kitchen, dining room, living room, bath room and bed rooms will be equipped with the most improved electrical domestic apparatus. There will be electric washing machines, flat irons, driers, wringers, etc., in the laundry, and in other rooms electric cooking machines, sewing machines connected with motors, vacuum cleaners, fans and ozonators.

Colorado Convention to be Held in October.

The eleventh annual convention of the Colorado Electric Light, Power and Railway Association will be held in Denver during the week of October 6. This will enable delegates to the convention to attend at the same time the Electrical Industrial Exposition, which is being planned by the Colorado Electric Club.

E. W. Lloyd.

While not alone responsible for the phenomenal development of central-station business in Chicago, still a goodly share of credit is due E. W. Lloyd, general contract agent of the Commonwealth Edison Company for the increases that have been made since he assumed the duties of this office in 1906. At that time the company served 53,000 customers, having an aggregate load of 153,764 kilowatts, while today the number of customers reaches the astonishing figure of 183,000, representing a total connected load of 413,434 kilowatts, this of course, not including the local street railway companies.

The part that Mr. Lloyd has played in this development is well known in the electrical fraternity. He was one of the first to appreciate the importance of commercial work in the central-station field and to recognize the value of a clearly defined commercial policy. He has instituted aggressive and progressive methods in the contract department of the Commonwealth Edison Company and has earned for his company and for himself an enviable reputation.

Naturally Mr. Lloyd has been deeply interested in the Commercial Section of the National Electric Light Association since its inception—in fact, he was one of its founders. He has contributed, by papers and reports of inestimable value, and in other ways, to the success of the Section and was fittingly rewarded at the last annual convention by being elected Chairman. How well he has filled the duties of this office is only partially evidenced by the program of the Commercial Section for the coming convention.

E. W. Lloyd,
Chairman Commercial Section, National Electric Light Association.

E. W. Lloyd was born in Belleville, Ontario, Can., on February 1, 1872. He attended schools in the vicinity and early in life moved with his parents to Erie, Pa., where he attended high school, graduating in 1890. Leaving school, Mr. Lloyd went to work at the steel mills in Pittsburgh, in the capacity of draftsman and after two years accepted a similar position with the Crane Company in Chicago.

In June of 1893, Mr. Lloyd accepted a position with the then Chicago Edison Company and worked in the drafting department and later on engineering tests until 1897. At this time he was transferred to the construction department as foreman.

Mr. Lloyd entered the sales department in 1900, handling the sales of the company's old apparatus and equipment. He also devoted considerable time to making valuations on isolated plants. In 1901 Mr. Lloyd was made assistant superintendent of construction and in 1906 was promoted to the position of general contract agent.

In addition to Mr. Lloyd's work in the Commercial Section of National Electric Light Association he is also active in general Association affairs, being chairman of the Rate Research Committee. He has also contributed valuable papers and reports to the Association of Edison Illuminating Companies, dealing principally with power and cost subjects, and to other technical and engineering bodies. He is an associate of the American Institute of Electrical Engineers; member of the Illuminating Engineering Society; Electric Club of Chicago and other local clubs.

The New York Companies' Section Meeting.

At the first meeting of the New York Companies' Section of the National Electric Light Association, under the chairmanship of H. M. Edwards, at the Edison Auditorium, 44 West Twenty-seventh Street, New York, a large attendance was present to hear Arthur Williams, general inspector of The New York Edison Company, speak on the subject of "Welfare Work." Mr. Williams has, for a number of years, been identified with the movement to solve the problem of a just and amicable relation between employer and employees.

Speaking of the wave of unrest that is in evidence all over the country just now, striking proofs of which are the recent disturbances in Lynn, Mass., and Paterson, N. J., Mr. Williams explained that the solution of this state of mind among the workers was "the making of partners out of the workers." Continuing, Mr. Williams said "bout 30 years ago a painter in France, a man who employed about 20 men, after much thought upon the matter, came to the conclusion that it was eminently unfair for him to take such a large part of the earnings of these 20 men from week to week. No matter what wages he paid there was always something at the end of each week that these men left with him. Thereupon he conceived the brilliant idea of taking the men into partnership with him, and from that beginning, almost 20 years ago, has come the idea of profit-sharing among employees, service annuities and several kindred plans."

Mr. Williams then went on to explain some of the advantages to be derived from membership in the New York Edison Savings and Loan Association, which is conducted under the auspices of the company and has the supreme advantage of having all expenses paid by the company and not from the savings of the association. Although just about a year old, the association now has about 900 members with a total of about $38,000, all invested in mortgages.

A lively discussion was had after Mr. Williams' talk; among the speakers being W. E. Freeman, of the New York Edison Company; F. W. Smith, of the United Electric Light & Power Company; C. A. Littlefield, and H. M. Edwards, of The New York Edison Company.

A musical program was rendered under the auspices of the Entertainment Committee.

The next meeting of the section will be held June 16 at the Edison Auditorium, and the Entertainment Committee has arranged for a vaudeville program, the evening to be set aside as ladies' night.

National Electric Light Association.

Program of Thirty-Sixth Convention, Chicago, June 2-6—General, Technical, Commercial, Accounting, Hydroelectric, Public Policy Sessions—Entertainment—Exhibits and Exhibitors.

The thirty-sixth convention of the National Electric Light Association will be held at Chicago, June 2 to 6. Sessions will be held in the various rooms of the new Medinah Temple at Cass and Ohio Streets, and the exhibit of the Class D members of the Association will be presented in the basement of Medinah Temple. An elaborate technical and entertainment program has been prepared, and it is expected that the attendants upon this convention will break all records established heretofore. The following program has been announced:

Tuesday, 10:00 A. M.—First General Session.

(1) Welcome to the city; (2) Address of President F. M. Tait; (3) Announcements; (4) Report of the Committee on Organization of the Industry, H. H. Scott, New York, Doherty Operating Company; (5) Report of Secretary, T. C. Martin, New York; (6) Report of Insturance Expert, W. H. Blood, Jr., Boston, Stone & Webster Corporation; (7) Report of Committee on Progress, T. C. Martin, New York, secretary, National Electric Light Association; (8) Report on Question Box, S. A. Sewall, New York; (9) Paper "Anticipation," Paul Lupke, Trenton N. J., Public Service Electric Company.

Tuesday, 2:30 P. M.—First Technical Session.

(1) Report of Meter Committee (with Third Edition of Code for Electricity Meters), W. H. Fellows, Washington, D. C., Potomac Electric Power Company; (2) Report of Committee on Grounding of Secondaries, W. H. Blood, Jr.; (3) Report of Lamp Committee, Frank W. Smith, New York, United Electric Light and Power Company; (4) New Incandescent Lamp Development, J. E. Randall, Cleveland, National Electric Lamp Association; (5) Paper "The Incandescent Lamp and Its Relation to Lighting Service," R. E. Campbell and W. C. Cooper, Cleveland, National Electric Lamp Association; (6) Report of Committee on Measurements and Values, Dr. A. E. Kennelly, Cambridge, Mass., Harvard University.

Tuesday, 2:30 P. M.—First Commercial Session.

(1) Address of Chairman of the Section, Edward W. Lloyd, Chicago, Commonwealth Edison Company; (2) Report of Finance Committee, T. I. Jones, Brooklyn, Edison Electric Illuminating Company; (3) Report of Membership Committee, J. F. Becker, New York, United Electric Light & Power Company; (4) Report of Publication Committee, Douglas Burnett, Baltimore, Consolidated Gas, Electric Light & Power Company; (5) Address, "How to Protect Business from Disturbance Caused by Panics," David R. Forgan, Chicago, President, National City Bank; (6) Report of Electric Salesmen's Handbook Committee, E. L. Callahan, Chicago, H. M. Byllesby & Company.

Tuesday, 2:30 P. M.—First Accounting Session.

(1) Report of Committee on Uniform System of Accounts, E. J. Bowers, Kansas City Electric Light Company; (2) Paper, "Accounting School and Education of Employees," A. L. Holme, New York, New York Edison Company; (3) Paper: "Methods of Keeping Prepaid and Accrued Accounts." Franklyn Heydecke, Newark, N. J., Public Service Electric Company; (4) Paper: "Office and Mechanical Appliances, Their Uses, Economies Effected, etc.," H. L. Lohmeyer, Baltimore, Md., Consolidated Gas, Electric Light & Power Company.

Wednesday, 10:00 A. M.—First Hydroelectric and Power-Transmission Session.

(1) Address of the Chairman of the Section, W. N. Ryerson, Duluth, Minn., Great Northern Power Company; (2) Report of Committee on Membership, R. J. McClelland, New York, Electric Bond & Share Company; (3) Report of Committee on Progress, T. C. Martin; (4) Report on Turbines, (report being part of National Committee report on Prime Movers), J. F. Vaughan, Boston, Stone & Webster Corporation; (5) Paper: "The New Type of Thrust Bearing," Albert Kingsbury, Pittsburgh.

Wednesday, 10:00 A. M.—Second Commercial Session.

(1) Report of Committee on Education of Salesmen, George Williams, New York, Henry L. Doherty Company; (2) Report of Committee on Electrical Merchandising, T. I. Jones, Brooklyn, Edison Electric Illuminating Company; (3) Report of Advertising Committee, J. Robert Crouse, Cleveland, National Quality Lamp Division, General Electric Company; (4) "Advertising for a Small Central Station," N. H. Boynton, Cleveland, National Quality Lamp Division, General Electric Company.

Wednesday, 10:00 A. M.—Second Accounting Session.

(1) Report of Sub-Committee on a Tentative Classification of Accounts Including Balance Sheet and Incident Accounts, John L. Bailey, Baltimore, Consolidated Gas, Electric Light & Power Company; (2) Paper: "Handling of Freight Bills," Albert S. Scott, Chicago, Public Service Company of Northern Illinois; (3) Paper: "Accounting for Replacement of Plant Retired From Service," Frank A. Birch, Philadelphia, Philadelphia Electric Company.

Wednesday, 11:45 A. M.—Second General and Executive Session.

(1) Paper: "Central-Station Power in Coal Mines, W. A. Thomas, Pittsburgh, Westinghouse Electric & Manufacturing Company; (2) Paper: "Switching Apparatus for Rural Installations," E. B. Merriam, Schenectady, General Electric Company; (3) Paper: "Central Stations for Towns of 5,000 Population or Less," J. Edward Kearns, Schenectady, General Electric Company.

Wednesday, 12:45 P. M.—Executive Session.

(1) Action on Report of Public Policy Committee, Arthur Williams, New York, New York Edison Company; (2) Presentation of Proposed Constitutional Amendments, Frank W. Frueauff, Denver, Denver Gas & Electric Company; (3) Report of Treasurer, W. W. Freeman, Birmingham, Alabama Power Company; (4) Election of Nominating Committee; (5) Appointment of Committee on Resolutions.

Wednesday, 8:30 P. M.—Public Policy Session.

(1) Reading of Report of Public Policy Committee; (2) Address by Samuel Insull, President, Commonwealth Edison Company, Chicago; (3) Report of Commission on Resuscitation from Shock, W. C. L Eglin, Philadelphia, Philadelphia Electric Company; (4) Lecture on "Accident Prevention in Public Utilities," J. B. Douglas, Philadelphia, United Gas Improvement Company; (5) Musical exercises during the evening by N. E. L. A. Section Band, Commonwealth Edison Company.

Thursday, 10.00 A. M.—Second Technical Session.

(1) Report of Committee on Prime Movers, I. E. Moultrop, Boston, Edison Electric Illuminating Company; (2) Report of Committee on Electrical Apparatus, L. L. Elden, Boston, Edison Electric Illuminating Company; (3) Paper: "Switchboard Instruments," Paul MacGahan, Pittsburgh, Westinghouse Electric & Manufacturing Company; (4) Paper: "Latest Developments in Distributing Transformers," E. G. Reed, Pittsburgh, Westinghouse Electric & Manufacturing Company; (5) Paper: "The Use of the Telephone in Central Stations," Angus Hibbard, New York, American Telephone & Telegraph Company; (6) Report of Overhead Line Construction Committee, Farley Osgood, Newark, N. J., Public Service Electric Company.

Thursday, 10:00 A. M.—Third Commercial Session.

(1) Reports of Electricity on the Farm Committees, (a) Eastern States, John C. Parker, Rochester, N. Y., Rochester Railway & Light Company; (b) Middle States, C. W. PenDell, Chicago, Public Service Company of Northern Illinois; (c) Western States, Stanley V. Walton, San Francisco, Pacific Gas and Electric Company; (2) Report of Committee on Wiring of Existing Buildings, Robert S. Hale, Boston, Edison Electric Illuminating Company of Boston.

Thursday, 10:00 A. M.—Third Accounting Session.

(1) Report of Sub-Committee on Statistics and Forms, C. L. Campbell Waterbury, Conn., United Electric Light & Water Company; H. Spoehrer, Union Electric, Light & Power Company: (2) Paper: "Obligations of the Bookkeeping Department to the Operating Department," H. Patterson, Rochester, Rochester Railway & Light Company; (3) Pa-

per: "Handling of Bond Coupons," W. J. Kehl, Richmond, Va., Virginia Railway & Power Company.

Thursday, 2:30 P. M.—Second Hydroelectric and Power-Transmission Session.

(1) Paper: "Poles and Pole Preservation," R. A. Griffin, Chicago, Western Electric Company; (2) Paper: "Lightning Arresters," E. E. F. Creighton, Schenectady, General Electric Company; (3) Paper: "Development in Protective Apparatus," J. N. Mahoney, Pittsburgh, Westinghouse Electric & Manfacturing Company; (4) Lecture "The System of the Mississippi River Power Company", Hugh L. Cooper, Keokuk, Iowa, Mississippi River Power Company.

Thursday, 2:30 P. M.—Fourth Commercial Session.

(1) Report of Committee on Ice and Refrigeration, George H. Jones, Chicago, Commonwealth Edison Company; (2) Report of Committee on Short Cuts in Executing Customers' Orders, George C. Holberton, San Francisco, Pacific Gas & Electric Company; (3) Report of Committee on Steam Heating, S. Morgan Bushnell, Chicago, Commonwealth Edison Company; (4) Report of Nominating Committee; (5) Election of Officers.

Friday, 10:00 A. M.—Third General and Fifth Commercial Sessions.

(1) Report of Rate Research Committee, E. W. Lloyd, Chicago, Commonwealth Edison Company; (2) Report of Street Lighting Committee, John W. Lieb, Jr., New York, New York Edison Company; (3) Faper: "Arc Lamps and Recent Developments Thereof," W. A. Darrah, Pittsburgh, Westinghouse Electric & Manufacturing Company; (4) Paper: "Advantages of Copper-Clad Wire for Series Arc Lighting," T. K. Stevenson, New York, Duplex Metals Company; (5) Report of the Committee On Underground Construction, W. L. Abbott, Chicago, Commonwealth Edison Company; (6) Lecture: "Light and Art," M. Luckiesh, Cleveland, National Quality Lamp Division, General Electric Company; (7) Address: "Objects of the Society for Electrical Development," Henry L. Doherty, New York.

Friday, 10:00 A. M.—Third Hydroelectric and Power Transmission Session.

(1) Report of Committee on Receiving Apparatus, H. R. Bump, New York, Henry L. Doherty Company; (2) Report of Committee on Distributing Lines, P. M. Downing, San Francisco, Pacific Gas & Electric Company; (3) Report of Committee on Operation of Water Power Systems, D. B. Rushmore, Schenectady, General Electric Company; (4) Factors Producing Reliability in the Suspension Insulator, A. O. Austin, New York, Ohio Brass Company; (5) Paper: "Transmission Line Construction," R. D. Coombs, N. Y., R. D. Coombs & Company; (6) Address: "Investigation of Life Hazards of High-Tension Lines, by the United States Bureau of Standards," S. W. Stratton, Washington, D. C.; (7) Election of Officers.

Friday, 2.30 P. M.—Fourth General and Third Technical Sessions.

(1) Paper: "Transformers and Power Transmission," H. H. Rudd, Pittsburgh, Westinghouse Electric & Manufacturing Company; (2) Paper: "Railway Loads for Central Stations," E. P. Dillon, Pittsburgh, Westinghouse Electric & Manufacturing Company; (3) Report of Committee on Award of Doherty Gold Medal, W. F. Wells, Brooklyn, Edison Electric Illuminating Company; (4) Report of Committee on Memorials, T. C. Martin; (5) Report of Committee on Constitutional Amendments, Frank W. Frueauff, Denver, Denver Gas & Electric Company; (6) Vote on Constitutional Amendments; (7) Report of Committee on Resolutions; (8) Report of Nominating Committee; (9) Election of Officers; (10) Adjournment.

Entertainment.

Monday evening, June 2: Opening of Exhibition and Reception at Medinah Temple.

Tuesday afternoon, June 3: Musical and and tea at the Blackstone Hotel, for visiting ladies.

Tuesday evening, 8:15 o'clock: Circus and vaudeville given by Commonwealth Edison Company and the Chicago Electric Club at Medinah Temple.

Wednesday afternoon, June 4: Trip to Hawthorne works of the Western Electric Company and trip to the Northwest Station of the Commonwealth Edison Company; Baseball game between the East and West at the Commonwealth Edison Company's Northwest Station property.

Thursday morning, June 5: Fifty-mile automobile tour through the North Shore suburbs with luncheon at the Hotel Moraine, for visiting ladies, leaving the Art Institute at 10 o'clock.

Thursday evening 6:30 o'clock: Sons of Jove Rejuvenation, Supper and Cabaret Show at White City.

On Wednesday afternoon there will also be side trips to Gary, the Sanitary District, Stock Yards, and Illinois Tunnel Company properties, for delegates who wish to visit these properties.

Exhibits and Exhibitors.

The main exhibit of the Class D members of the National Electric Light Association will be placed in the spacious basement of Medinah Temple. A notable presentation of the most modern central-station equipment has been arranged under the direction of the Exhibition Committee, composed of J. C. McQuiston, chairman; James J. Ayer, Charles Blizard, S. E. Doane, George B. Foster, Frank H. Gale, John F. Gilchrist, F. M. Jewett, Homer E. Niesz, J. W. Perry, H. G. McConnaughy, secretary and treasurer. The following exhibitors have been listed up to the time of publication:

Adams-Bagnall Electric Company, Cleveland, O., will make an exhibit consisting mainly of a demonstration of the A-B 120-hour focusing-type series alternating-current flaming-arc lamp; a five-kilowatt constant-potential A-B transformer of 110-volt primary, 440-volt secondary, in circuit with one A-B five-light, 7.5-ampere constant-current transformer with one A-B 25-light single-circuit switch panel, to burn three 7.5-ampere series flaming lamps; there will also be on this same circuit of lamps one 10-ampere series flaming lamp with current compensator. There will also be shown different types of brackets with series sockets and reflectors for A-B series Mazda lighting; also different types of Jandus fans and Gyrofan; a complete line of automobile accessories, consisting of the A-B trumpet, electric vibrating horn, and ABAutoLites for electric lighting of Motor cars. In attendance will be C. L. Eshleman, V. N. Marker, C. W. Beach, R. H. Green and A. J. Selzer.

American District Steam Company, North Tonawanda, N. Y., will maintain its booth more as a reception room or place where its representatives may be found by any one desiring to talk over in detail the many advantages of the combination electric light, power and steam heating plants as compared with operating a plant condensing. The company will exhibit models of fittings used in connection with its underground steam-main construction, also models of its Simplex condensation meter with glass front showing interior, and nickel-plated model of underground main, together with copies of all the latest bulletins, catalogs, etc. The company's representatives will probably be W. H. Wells, president; C. R. Bishop, secretary and general manager; H. C. Kimbrough, western manager; B. T. Gifford, manager engineering department; A. E. Duram, mechanical engineer; W. J. Kline, C. A. Gillham and J. A. Bendure.

Benjamin Electric Manufacturing Company, Chicago, will show quite a complete line of fixtures for industrial work, stores, and office buildings, as well as a line of store-front lighting fixtures, and other fixtures suitable for outdoor work; plug clusters and switch-controlling current taps will be featured. The representatives will be R. B. Benjamin, president; W. D. Steele, vice-president; H. E. Watson, sales manager; A. N. Fox, advertising manager; B. G. Kodjbanoff, eastern manager; F. H. Poss, Pacific Coast manager; G. B. Weber, A. E. Lubeck and M. F. Steel.

Chicago Fuse Manufacturing Company, Chicago, will exhibit its entire line of switch and outlet boxes, including several new types of the fittings that have been developed to meet the requirements of contractors, particularly in connection with reinforced-concrete work and tile partitions that are being so extensively used in the larger cities in building construction; the exhibit will also cover a complete line of fuse and cutout material, including the larger capacity of fuses ranging from 600 to 1,000 amperes, together with fittings for the same. In attendance will be Arthur S. Merrill, W. E. Finlay, W. W. Merrill and G. W. Borst.

Century Electric Company, St. Louis, Mo., will show Century single-phase motors, Invincible split-phase motors and Century alternating-current fans. Representatives will be R. J. Russell, secretary; H. A. Porter and J. F. Kadic, of the Chicago office.

Duncan Electric Manufacturing Company, La Fayette, Ind., will exhibit a complete line of house-type watt-hour meters for both alternating and direct-current, ranging as high as 10,000 amperes in the direct-current instruments and 1,000 amperes in alternating-current meters. Special attention will be called to the new model E ½, which made its debut about one month ago and is reported as favorably impressing central-station managers; this new me-

ter is somewhat smaller in dimensions than any type previously put upon the market by the company and unlike small direct-current meters, it possesses much better characteristics than larger meters that have been made in the past; its ratio of torque to weight is very high; its readings when subjected to variations in pressure are absolutely correct, and its characteristic upon all loads is represented by a straight line; the registering train is placed at the center of the meter which permits the maximum amount of space between the series-field coils and the magnets, and renders the magnet immune from the demagnetizing effect of the series-field coils; the mechanical arrangement of the different parts constituting the meter is claimed to be ideal and everything works towards stability and simplicity. The company will also have on exhibition a full line of portable test watt-hour meters, and its portable alternating-current meter will be shown at the convention for the first time. The line of shunted-type direct-current watt-hour meters for switchboard service will present a fine appearance; these meters are provided with plate glass covers and are handsomely finished in polished copper and dull black. Those in attendance will be A. G. Lucas, of Chicago, representative; George Pfrommer, Wm. A. Sinks, John A. Clark, Homer G. Hall and Fred L. Pauli, of Lafayette, Ind.

Duplex Metals Company, New York, will exhibit specimens of copper-clad bare and weatherproof wire; copper-clad hot-rolled rods; copper-clad wires, showing the product before it has been rolled from rods into wire; also copper-clad trolley-wire strand, choke coils, etc. Representatives will be S. C. Munoz, vice-president and general sales manager; T. Kennedy Stevenson, chief engineer; C. B. Semple, western sales manager; W. T. Kyle, eastern sales manager; W. D. Ball, W. H. Lipscomb, L. M. Gordon, E. F. Cameron and J. P. Brundage.

Economy Fuse and Manufacturing Company, Chicago, will display a sample of each type of its fuses, together with renewal links for same and a miscellaneous collection of fuses both complete and in section; also a small exhibit of its product which was submerged in the recent Ohio floods. The chief exhibit will be a demonstration of performance of the product in service along the lines of rating and short-circuit. In attendance will be A. L. Eustice, general manager; J. B. Griffith and A. E. Tregenza.

Electric Appliance Company, Chicago, will exhibit the A. W. regulator, both station and pole type, also a full line of Delta-Star high-tension protective apparatus. The company will be representated by W. W. Low, president; P. R. Boole, general sales manager; F. J. Alderson, manager engineering department; and a number of salesmen from nearby territories.

The Electric Storage Battery Company, Philadelphia, Pa. Exhibit will consist principally of a large table upon which are to be displayed various types of battery plates manufactured by the company, several views of its works and a collection of new publications of interest to members of the Association.

Electric Vehicle Association of America, New York, will show matters relating to the publicity and advertising campaign it has carried on during the past year on behalf of the electric vehicle. Samples of the advertising copy used will be shown and perhaps statements from some of the electric vehicle manufacturers, indicating how sales have been increased. Copies of the last report of the Publicity and Advertising Committee will be on hand for distribution. An attempt will also be made to tell of plans for the second year. It is hoped that many or all of the western central-station companies may be won over to financial support of the movement. A representative of the advertising agency of the Wm. D. McJunkin Company, and Harvey Robinson, secretary of the association, will be in attendance.

Eureka Vacuum Cleaner Company, Detroit, Mich., will have a display of the Eureka electric vacuum cleaner, showing the machine in use together with its various working parts. Fred Wardell, president; R. Field, assistant to the president, and O. B. Schubert, Chicago manager, will be at the booth.

Federal Sign System (Electric), Chicago, will exhibit its line of electric signs, including the miniature-letter window signs; also its line of porcelain enameled-steel shades, units, fixtures, the Federal vacuum cleaner, washing machine and kitchen power table; Federal indirect fixtures, Sangamo meters, Pittsburgh transformers, Metropolitan Engineering Company's meter-protecting devices and the Dayton Pump & Manufacturing Company electric house pump. Representatives will be H. 1. Markham, general manager; James M. Gilchrist, secretary; L. G. Shepard, electrical engineer; J. S. Macpherson, general auditor; A. R. Gibbons, advertising manager; W. Scott, claim and traffic manager; G. G. Beck, purchasing agent; G. B. Keil, superintendent; G. E. Fuller and A. R. Dean.

G. & W. Electric Specialty Company, Chicago, will have an exhibit of cable terminals, junction boxes, high-tension fuses, disconnecting switches, etc. George P. Edmonds, sales manager, and J. M. Hundley will be in attendance.

General Electric Company, Schenectady, N. Y., will exhibit samples of its three types of ornamental luminous arc lamps, type W long-life flame arc lamps for both series and multiple service, and the four-ampere pendent type of luminous arc lamp; some interesting views of street illumination will be shown in a novel manner. The color-matching outfit which will be shown gives a light which is the nearest approach to daylight of any artificial illuminant, and makes it possible to match colors perfectly. The incandescent-lamp exhibit will consist of two lamp racks on which will be mounted all sizes and styles of Mazda lamps suitable for household, industrial, store and automobile lighting. A very complete exhibit of ozonators will be shown, which will include both the alternating-current and direct-current types; those designed for operation from direct-current circuits will be in operation and will demonstrate the effectiveness of this device for deodorizing and purifying the air. A graded shunt-resistance multigap and a compression-chamber multigap lightning arrester will be shown; these will be mounted on a wooden panel and operated by induction coils to demonstrate their operations. A 6,600-volt aluminum lightning arrester will be exhibited with the tank cut away so as to show its interior construction. The exhibit of arresters for 600-volt direct-current circuits will contain one of the aluminum type and one of the magnetic blowout type; a vacuum lightning arrester for signal circuits will also be shown. Among heating devices exhibited will be a domestic range, a model vertical cabinet arranged with overhead oven, a horizontal cabinet range, and a bake oven with complete set of grids. A mercury rectifier of the runabout type will be exhibited in operation; this is designed for charging electric vehicles at home and can be operated by anyone. The exhibit of electrical measuring instruments will contain a standard wattmeter, a millivoltmeter with portable shunt, a type S-2 volt-ammeter for signal work, and a DK-3 automobile instrument; the latter two instruments measure both current and potential and are very compact. There will be a representative exhibit of fractional horsepower motors, consisting of buffing and grinding outfits, portable drills, sewing-machine motors, etc. The fan exhibit will be very complete, comprising samples of nearly all types. Among other devices exhibited will be a potential regulator and condenser sections, a cutout relay, a resistance box, and a speed regulator. An automatic pole-type regulator and a hand-operated pole-type regulator will also be shown, these being in operation. What is expected to be one of the most attractive features of the exhibit will be what is known as a multi-recorder. This is a device for recording the time, to the second, of the occurrence of any phenomenon which can be made to close an electrical contact. It prints a record on a strip of paper when in operation. So rapid is the stopping mechanism for this movement that it is possible to record five separate events in one second. The Fort Wayne Works of the company will have an exhibit consisting of bell-ringing transformers, toy transformers, sign-lighting transformers, pressure switches, series incandescent regulators, fractional horsepower motors, etc. The Holophane Works of the company will have an exhibit of shades and reflectors in prismatic glass, ornamental Veluria, cut and etched glass, semi-indirect bowls, opal reflectors and metal reflectors. The General Electric Company will be represented by the following: N. R. Birge, R. H. Carlton, D. R. Bullen, Frank H. Gale, A. W. Burchard, E. W. Rice, Jr., D. B. Rushmore, E. E. F. Creighton, C. A. S. Howlett, G. F. Morrison, C. B. Burleigh, H. B. Rogers, H. C. Ward, W. H. McLaren, E. E. Gilbert, C. W. Stone, H. R. Summerhayes, E. B. Merriam, F. G. Vaughen, C. P. Steinmetz, E. P. Edwards, R. E. Woolley, A. K. Baylor, R. T. Wagner, C. R. Croninger, R. A. Swain, J. C. Kearns, D. S. Martin, W. M. Stearns, S. H. Blake, A. D. Page, H. Schroeder, R. B. Parker, G. C. Osborn, F. W. Sanford, J. W. Howell, G. N. Chamberlain, E. L. Barr, M. Tattersfield, G. L. Thompson, E. H. Ginn, T. W. Moore, P. Worth, T. J. Ryan, T. E. Bibbins, H. M. Hall, J. A. Cranston, Wm. Hand and J. H. Livsey.

General Vehicle Company, Incorporated, Long Island City, N. Y., will show a 1,000-pound G. V. chassis. In attendance will be E. E. Witherby, district manager; W. J. McDowell, of Chicago office, and probably E. W.

Curtis, Jr., and H. W. Hillman from President Wagoner's office.

Hotpoint Electric Heating Company, Ontario, Cal., will display a representative number of its heat appliances. In attendance will be J. R. Richardson, M. J. Wolf, R. S. Marsh and W. A. Richards.

Hubbard & Company, Pittsburgh, Pa., will exhibit the newer features of the Peirce line of of insulator brackets, together with a stamped-steel pole, the Bo-Arrow high-tension arm, and several other new high-tension fixtures just brought out. Representatives will be C. L. Peirce, Jr., O. W. Youngquist and W. R. Pounder.

Hughes Electric Heating Company, Chicago, Ill., will exhibit a full line of electric ranges, stoves and radiators. The company will be represented by George A. Hughes, president; A. F. Vaughan, George J. Brucker, and Miss Anna Smith.

W. N. Matthews & Brother, St. Louis, will exhibit two full-size electric light poles, equipped with all the most up-to-date material, including the following Matthews specialties: Boltless and two-bolt guy clamps, guy anchors, cable clamps, fuse switches and cable hangers. In addition will be shown the Telefault, Telepipe, Teleheight, Holdfast lamp guards and Easy lamp changers. Claude L. Matthews, Walter E. Bischoff, Victor L. Crawford and John L. Fay will be present.

Metropolitan Engineering Company, New York City, will display a full line of meter protective devices, including testing cutouts, entrance switches, high-tension fuses and a demonstration under actual service conditions of the transformer network protector. F. E. Brown and J. E. McClernon will be in attendance.

Minerallac Electric Company, Chicago, will have an exhibit of printometers, Maxicators and Graphometers; also an exclusive exhibit of maximum-demand devices. In attendance will be H. S. Sines, J. Van Buskirk, C. I. Hall and A. J. Olson.

Moloney Electric Company, St. Louis, will show as nearly as possible examples of all the different types of its transformers. Representatives will be T. O. Moloney, president; Jas. J. Mullen, vice-president, and L. H. Keller.

National Quality Lamp Division of General Electric Company, Cleveland, will exhibit a complete line of regular and miniature Mazda lamps. A striking feature of the exhibit is to be a representation of a switchboard panel on which several mechanically operated meters will indicate the effect of variations in the voltage impressed on Mazda lamps on central-station revenue and on the amount of light obtained by the consumer. This apparatus presents very forcibly the economy of burning incandescent lamps at a voltage not lower than their rated voltage and demonstrates graphically the contentions made in the "Proper Lamp for a Circuit" campaign conducted by the National Quality Lamp Division. A moving display of the parts of a Mazda lamp which will be brought into view in their proper sequence will portray the process of manufacture of the lamp. A Tunstolier Truetint device will be demonstrated, showing how materials of different colors appear under Mazda light and under daylight produced by correcting Mazda light by means of colored glass disks. The proper lighting of show cases will be illustrated by means of a modern glass case fitted with Mazda units. The booth will be in charge of F. J. Blaschke assisted by R. W. Tavey. Other National representatives will be J. Robert Crouse, S. E. Doane, chief engineer, National Electric Lamp Association; W. M. Skiff, manager, engineering department, National Electric Lamp Association; N. H. Boynton, E. J. Edwards, C. W. Bender, Ward Harrison, R. W. Shenton and M. D. Cooper.

Oshkosh Manufacturing Company, Oshkosh, Wis., will show its well known line of construction material and including such tools as pike poles, raising forks, construction shovels, etc.; also specialties, such as Roberts patent climber, Oshkosh patent folding take-up reel, Kalkeen insulator pins and the new Oshkosh pole anchor. Representatives will be J. W. Wooley, E. C. Leach and R. L. Thayer.

Philadelphia Electrical & Manufacturing Company, Philadelphia, will display three ornamental lighting standards, the center standard consisting of an iron base and pipe column to which are attached eight bracket arms and supporting Pemco tungsten arcs; the corner fixtures will be arranged to show the series tungsten fixtures and other Pemco products. R. H. Manwaring, and W. O. Dale, will be in attendance.

Pittsburgh Transformer Company, Pittsburgh, Pa., will have a booth fitted with large-sized photographs of the factory's latest product in transformers of all sizes, including the heavy duty mill-type transformers; the photographic details of the Pittsburgh street series lighting system will also be placed on exhibition and special photographic reproductions of the new outdoor high-tension transformers for voltages up to 66,000 volts. As usual, 10,000 Pittsburgh stogies will be furnished to the convention delegates. In addition the usual "Pittsburgh Pretty Girl" will be distributed in the form of the new two-page folder specially gotten up for the convention. In attendance will be R. V. Bingay, president; H. G. Steele, secretary and treasurer, and P. H. Butler, sales manager.

John A. Roebling's Sons Company, Trenton, N. J., will show a complete line of its products, including bare iron, steel and copper wire, wire rope and fittings, alligator wrenches, wire netting and all kinds of insulated wire and cables. The company will be represented by A. B. Conover, W. H. Slingluff, J. R. Summerfelt, E. A. Cristoph, A. L. Seaman and A. V. Errickson.

Sangamo Electric Company, Springfield, Ill., will show two panels equipped with its various types of meters. Another separate panel showing the arrangement of the ampere-hour meter and circuit-breaker built for the Pennsylvania Railroad, another pedestal with meter operating distant-dial mechanism, and one of the latter on a pedestal at the front of the exhibit. Will be represented by H. W. Young, Chicago manager; J. H. Hodde, A. E. Pickard, R. C. Lamphier, and probably others.

Simplex Electric Heating Company, Cambridge, Mass., will display a complete line of heating appliances for both domestic and commercial use, including many new devices. In attendance will be James I. Ayer, E. R. Jacobs, J. H. Johnson and E. D. Rollins.

Standard Underground Cable Company, Pittsburgh, will exhibit samples of various styles and sizes of electric cables, cable junction boxes of various sizes and for different voltages, cable terminals for outdoor and indoor service, samples of Ozite insulating compound and cable-splicing sleeves, etc. Representatives will be G. L. Wiley, of New York; E. J. Pietzcker, St. Louis; J. K. Lytle and R. B. Wilcox, Pittsburgh; J. R. Wiley, R. E. Green, E. F. Norton and W. M. Rogers, Chicago.

The Thompson Electric Company, Cleveland, will show its new high-voltage series cutout hanger, which makes possible a straight-line system of wiring, eliminating all dangling loops of conductor wire and safeguarding the circuit as completely at and through the hanger as at any other point on the line; it safeguards the trimmer particularly, as he cannot possibly touch the lamp until it has been absolutely disconnected from the circuit. There will also be exhibited samples of large and small multiple cutouts which are being adopted by the leading industrial plants all over the country. A. J. Thompson, president, will be in charge.

Tungstolier Works, General Electric Company, of Conneaut, O., will display comprehensive lines of fixtures for central-station use embodying a fixture for every room in the house, each fixture wired with sockets and holders and having the glassware included; those include a range of eight separate and distinctive outfits at prices ranging from the moderate to the most pretentious type of fixtures. In commercial lighting units there will be shown the latest development consisting of consolidated folding fixtures which provide a complete lighting unit of the necessary number of lights all folded up complete with all connections made ready for installing on the ceiling, each unit being packed in a pasteboard carton which protects it against damage either in transit or in the hands of the workman. Another feature of the Tungstolier display will be a new and complete range of units for lighting factories, foundries, mills, warehouses, wharves, railroad yards and streets; interchangeable parts make it possible to adapt from a very limited stock any of the fixtures in this industrial line to the varying needs of the central station or dealer. There will also be shown a line of close ceiling units which are found to embody exceptionally high values at very attractive prices. Tungstolier representatives will be Glenn C. Webster, manager; F. C. Maxheimer, sales manager; A. B. Wilson, J. B. Higgins, W. G. MacMartin and C. F. Reel.

Wagner Electric Manufacturing Company, St. Louis, will exhibit samples of its line of alternating-current apparatus, including the unity power-factor single-phase motor, the converter and the rectifier. The converter changes alternating current to direct current for charging vehicle batteries and for other work, such as motion-picture machines. The rectifier changes commercial alternating current to six or eight-volt direct current for charging small storage batteries, such as those used on automobiles for ignition and lighting. The Wagner delegation will include W. A. Layman, president; Walter Robbins, F. N. Jewett, John Mustard, E. W. Goldschmidt, E. H. Cheney, Fred Johnson, A. J.

Myers, J. A. Gelzer, and Ray D. Lillibridge.

Western Electric Company, New York and Chicago, will exhibit a line of current-consuming devices, consisting of Western Electric American heating appliances, Western Electric Sturtevant vacuum cleaners, Western Electric fans, and Sunbeam incandescent lamps; also an assortment of supply material, consisting of Tungstoliers, Holophane reflectors, Benjamin industrial lighting fixtures, D. & W. fuses, Buffalo grips and Thomas insulators. A unique feature will be a joint electric light and telephone pole line completely equipped with both high-tension and telephone line material; this line will be fitted up in accordance with modern line-construction practice. There will also be shown telephone apparatus, consisting of a complete line of the Western Electric Interphones, a working exhibit of Western Electric loud-speaking telephones, also special telephones and accessory equipment for use along high-tension power lines. The company's representatives will be H. R. King, power apparatus sales manager; R. A. Griffin, manager pole department, and A. G. Kingman, from the New York office; H. L. Grant, sales manager; J. F. Sweeney, W. B. Pierce and Wm. Mueller, from the Chicago office.

Westinghouse Companies will have a large, joint exhibit. Westinghouse Electric & Manufacturing Company will show several general utility motors and these for general household, office and store use; a complete line of heating apparatus for domestic and industrial uses, including toaster stoves, disk stoves, irons, coffee percolators, frying pans, chafing dishes, sterilizers, luminous radiators, air heaters, heating pads, milk warmers, tea samovars, tire vulcanizers, glue pots, chocolate warmers, etc. There will be an assortment of fan motors of all kinds showing the new lightweight and efficient drawn-steel frame fans for use on alternating-current and direct-current circuits. There will be several ozonizers and a rack containing insulating materials and the Westinghouse solder, known as Weldwell. A display will be made of arc lamps of the flame-carbon type for operation on alternating-current and direct-current circuits, multiple and series; a Westinghouse-Cooper Hewitt battery-charging mercury rectifier outfit with a time switch for ending the charge at any predetermined time; a mechanical (vibrating) rectifier for charging ignition batteries; a bell-ringing transformer and distributing transformers of 5 and 7.5-kilowatt capacity with fuse blocks; a switchboard panel with complete equipment; meters of all kinds, indicating, watt-hour, graphic and precision; carbon circuit-breakers, from 12.5 amperes to 6,000 amperes capacity, and oil breakers as high as 44,000 volts; one of the Westinghouse condenser-type terminals for indoor and one for outdoor use; lightning arresters for every kind of service, including the multipath and the electrolytic types with horn gaps of different voltages. The Westinghouse Lamp Company will show a complete line of 100 to 130-volt Westinghouse Mazda lamps; also an educational exhibit of tungsten in its various stages of manufacture. The Westinghouse Machine Company will exhibit a turbine-driven centrifugal boiler-feed pump having a capacity of 450 gallons per minute. The Cooper Hewitt Electric Company will exhibit one of its new quartz lamps. Among the Westinghouse representatives will be Guy E. Tripp, chairman board of directors, and A. A. Brown, M. C. Rypinski, D. E. Drake and A. E. Allen, of New York City; L. A. Osborne, vice-president, and S. L. Nicholson, G. B. Griffin, C. S. Cook, H. W. Cope, Robb Mackie, C. E. Allen, E. P. Dillon, S. A. Fletcher, A. D. Fishal, S. E. Chase, S. D. Levings, T. A. McDowell, J. C. McQuiston, J. N. Mahoney, Paul MacGahan, T. J. Pace, E. G. Reed, C. G. Reed, C. G. Schlueder berg, and W. A. Thomas, of East Pittsburgh; G. C. Ewing, J. M. Tomb and H. H. Van Staagen, Boston; J. McA. Duncan and A. H. McIntyre, Pittsburgh; J. J. Gibson, Philadelphia; Wm. Clegg, St. Louis; T. E. Collins and C. E. Heise, San Francisco; K. E. Van Kuran, Los Angeles; J. S. Tritle, Kansas City; G. S. Vail, Cleveland; J. A. Brett and E. O. Kirpatrick, Cincinnati; H. C. Owens, Baltimore; E. A. Thornwell, Atlanta; besides a large delegation from the Chicago office. The Westinghouse Lamp Company will have in attendance Walter Cary, vice-president and general manager, T. G. Whaling, B. F. Fisher, Jr., A. J. Cole, A. N. Brown, H. C. Auran, L. N. Pyle, L. Schofield and F. C. Barrington.

Weston Electrical Instrument Company, Newark, N. J., will exhibit a rather complete line of Weston indicating instruments for both alternating and direct-current service, including also a full exhibit of the new miniature precision instruments for direct current and instrument transformers for alternating current. The exhibit will be in charge of Charles P. Frey.

Theodore N. Vail on Business Conditions.

In a recent newspaper interview, Theodore N. Vail, president of the American Telephone & Telegraph Company, expressed himself as follows:

"It seems to me that the fundamentals are sound. Most of our troubles are therefore susceptible of rapid and decisive improvement. From the security-market standpoint it is entirely possible that the tendency toward depression may persist for some months more, but with underlying conditions as favorable as they are today, the recovery to a more normal and happier frame of mind is merely a matter of time and patience.

"People tell me that the money markets are under close sail and that the money pilots have cautioned against stormy times ahead. This is the very best guarantee in the world that we shall not have them. These same conservatives forget the fact that we are today laboring under the strain of having to assist in the great work of financing Europe through its war troubles and that business expansion has been held in check in this country as by an iron leash.

"Every bit of development work, every new enterprise which it has been physically possible to hold back, has been stopped or not initiated. Business is simply normal—what is barely necessary to keep the country in operation as a going concern, and no more. We have slowed down so far that when activity starts in again, say in another year or two years, in a big way, we shall probably be so cramped for railroad and industrial facilities that the problem of handling the volume of business pressing for transaction will choke our arteries of commerce and flood our mills and factories to a point making economy of operation exceedingly difficult. That is one of the most serious troubles today and not the Balkan war, the tariff or tight money. We have slowed down too far and too fast and we shall have to pay an excessive price for expansion when the demand is here.

"Business in the United States adjusts itself to change with wonderful facility. That is the history of the past. It will be the history of the future. I am not worrying over the tariff nor prostration in industrial New England. What we want is more courage, and a disposition to make the best of things, remembering that in this very human world expediency and a sense of compromise are the part of wisdom and discretion."

Economy Resulting From Electrification of a Large English Colliery.

The American consul at Birmingham, England, states that electrification has not been adopted to any great extent in the coal district near that city, and for that reason the electrification of the Cannock Chase colliery has been of some considerable interest. This electrification had to provide for mines at some distance from one another, so that cost of operation is somewhat higher than would normally be the case. Some $103,457 was expended upon electrification, and it is calculated that as a result there is an annual saving of $19,203, or about 18.5 per cent on the outlay. As a result of this electrification the coal consumption has been reduced by about 6,875 long tons, 25 horses have been dispensed with for underground work, there has been a great reduction of labor by substitution of electrical for horse haulage, and current is available for further extension and lighting up important stations. It is calculated that the cost of this is about one cent per kilowatt-hour.

A telephone system, American throughout in equipment and providing a service equal to that of any city in the United States, has recently been installed in Bahia, Brazil, and is giving complete satisfaction to subscribers.

Organizing a New-Business Department.

By E. L. Callahan.

The object of this article is to offer helpful suggestions to those in charge of new-business departments of electric light and power companies in the organization and management of their departments.

Sales work in any line of business is extremely important. The successful results of a sales department furnish the life blood of the institution. In the past few years the necessity for a new-business department in a public utility supplying a community with electric light and power service has been demonstrated. The business of selling electric service to the public has come largely into the hands of practical business men; therefore, business methods are applied in very much the same manner as they are in a mercantile line, with this difference, namely, that the public-utility business is obviously far more difficult to manage.

In this article the reader is asked to picture in his mind a city of average business opportunities, size, progressiveness and natural resources, and to follow the author in the organization of a new-business department necessary to properly develop the field in the use of electricity. The city, conditions and results are not actual, but are intended to represent the prevailing average, upon which the results described are possible and practicable.

Looking Over the Field.

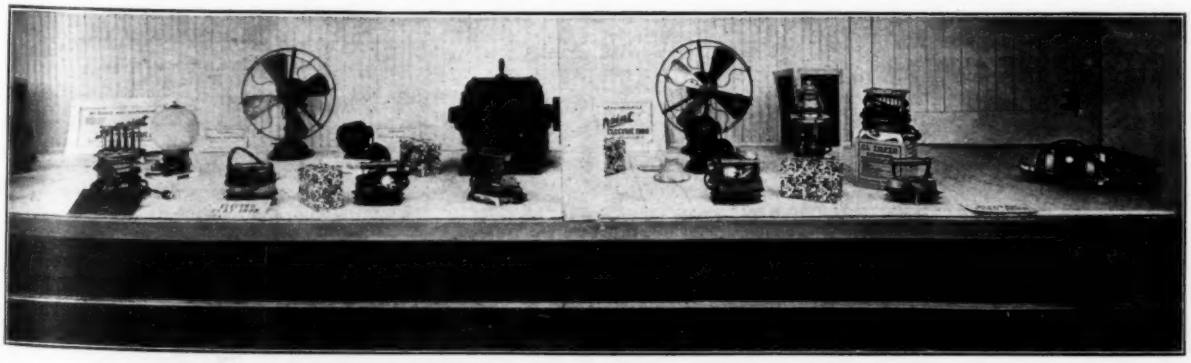
It should be remembered, however, that no two situations require the same prescription to successfully effect electrical development.

Customer's Rest Room.

The scene of action is the city of Powerfield, with a population of 200,000; the name of the company, The Electric Service Company of Powerfield. It is assumed that the city of Powerfield has had a steady growth in population and wealth, is quite an important railroad and manufacturing center, and is the center of a rich agricultural section with other natural resources in stone quarries and clay for brick and pottery manufacture, etc. The immediate field for electric light and power is widened by the evident prospective business through line extension into rural districts to furnish current for pumping for irrigation and other purposes.

The business men of Powerfield, as in any city, are keen and alive to advantages to their own business and personal interests, possessing the degree of civic pride that is necessary for any city to progress.

For the purpose of our story, assume that the old central-station company of Powerfield has just been taken over by a new company, the officers and manager of which are comparative strangers to the citizens, that the generating plant and distributing system are in good condition with ample reserve capacity, and that the old company has had a good record for continuous service; that it has paid its bills, interest and dividends on bonds and stock and held the respect of the community. It, however, had never occurred to the officers of the old company that there was a gold mine unopened at their very feet, for they never had seriously contemplated furnish-



Typical Show-Window Display for Central-Station Company.

ing power service to the large railroad shops, packing plants, several small flour mills, street car company, large shops and factories of various kinds in the city, to say nothing of taking on business within a few miles of the city limits, including small towns and villages.

An excellent barometer of an electric lighting and power company's business is its station load curve and average load-factor. Looking at the station load chart one instantly understands that the old company in Powerfield contented itself in taking principally peak lighting and small power business.

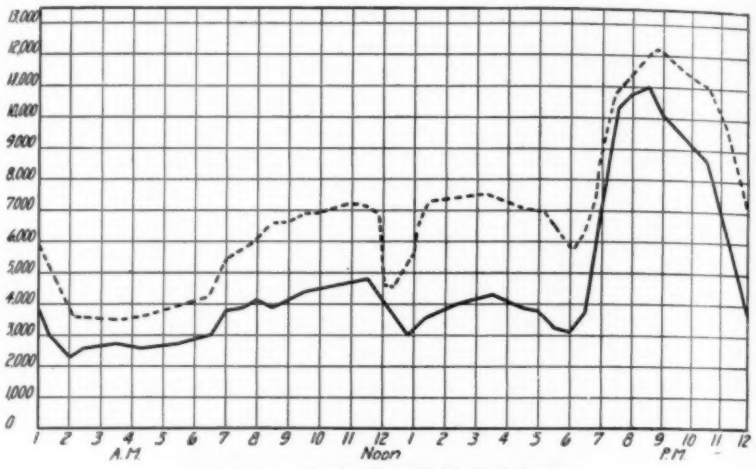
Policy of the New Company.

The aim of the officers of the new company is to double the present net revenue in as short a space of time as is possible, meanwhile increasing the maximum demand upon the station as little as possible; to popularize the use of electricity and the company in the public eye and to give every customer and citizen a fair and square deal. Results of this kind require the establishment of and adherance to a broad and liberal business policy, giving of good service and obtaining all the business possible at rates as low as is consistent with good management. There may be little in a name, but for a public utility company having for sale service, the author believes there is none better than the one chosen for Powerfield, viz., "The Electric Service Company."

The new board of directors met in the office of the former president and decided that an up-to-the-minute new-business department should be organized immediately to develop profitable power and lighting business, prevent the installation of isolated plants in the future and to push the development of the residence business, particularly as to the use of service during off-peak hours. An appropriation covering the entire expense of the new-business department, not to exceed three per cent of the annual gross revenue, was made for the first year, and thereafter 2½ per cent. Of this amount not more than one-half was to be spent by the advertising division of the department during the first year, and two-fifths thereafter.

Organization of New-Business Department.

The old company had employed several "solicitors," principally because they were "good fellows about town." The manager of the company realized that the first requisite for his new-business department was a competent man to take full charge under his direction. The matter was important and delay dangerous to the interests of his company; therefore, he made a quiet tour of inspection and investigation, having in mind several men who had made good in getting results in cities of about the same size as Powerfield. The man for the place was finally found; the highest tribute being paid him by merchants and business men in the city where he had previously worked; to them he was best known for the straightforward business methods that he employed, his keenness of perception, and the ability to convince and close contracts—they said he was a man who could "come back"; with his former employers he was the man who "got the business at regular rates." This young man had a technical education, topped off by several years of practical experience in apparatus testing and central-station sales work all the way from residence salesman to chief power salesman, with the additional personal qualification or faculty of leading rather than driving.



Load Curve of "Powerfield" Central Station.

The success of any organization like that of a public-utility company is materially furthered through the proper esprit-de-corps of its employees. Hence, being a man of considerable experience and executive ability, the manager of the company at Powerfield called the heads of the different departments together from time to time for heart-to-heart talks on the successful conduct of the company's business; arrangements were made for occasional evening meetings of all employees for the double purpose of their entertainment and enlistment of their hearty support in the company's interest, thereby creating a spirit of co-operation one with another and one department with another, and the realization by each that he alone as well as his department had an important work to perform well in order that the best interests of the company and the public be served.

1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31

Address _____ Class _____

Name _____ Owner Tenant Date _____

Now using Electricity Gas Oil Avg. No. Bill, $ _____

Wired No. of Lamps _____ C. P. _____

Kind of Fixtures Electric Gas Combination Drop Cords

Piped Mantels Open Burners _____

If Wired, but not using, why _____

Kind Watts

Electric Iron Other Appliances _____

Brick Frame No. Rooms _____

Interested in _____

Estimate Furnished on _____

Call Back

Residence Data Card.

Upon the obtaining of sufficient new business and the retention of old business to make an adequate return in profits to the company depended to a large extent the future prosperity of each employee; it was easy, there-

fore, for the employees to see that the intelligent support of the new-business department was vital. On the other hand, the salesmen in the new-business department realized that they could assist the management and other departments through bringing to the attention of their chief, matters that would tend toward the rendering of better service. Likewise, in maintaining desirable relations and continuance of business between the company and its customers it was necessary that the "complaint," or better called "adjustment" and collection departments kept in close touch with the new-business department. In extreme cases salesmen often could make adjustments, collections and prevent cutouts much more effectively than anyone else.

A Determined Effort

To Better Serve The People

The Electric Service Company will make an unusual effort to serve the electrical needs of Powerfield's citizens in the most satisfactory way.

Toward the realization of this end we have inaugurated a **New-Business Department,** the purpose of which will be to study the needs of customers to serve them better.

Electrical experts have been secured in order to make this Department valuable to our patrons.

Every new application of electricity in the home, factory, office and store will be investigated by the Department and every new method of **practical merit** will be introduced.

We extend to the citizens of Powerfield without cost to them the assistance and advice that our experts may render.

Our motto is **"The Customer Must Be Pleased."**

Let our **New-Business Department** contribute to your pleasure and profit.

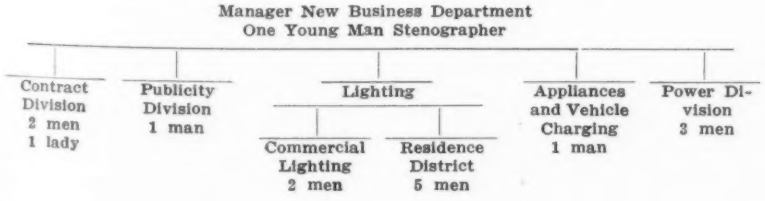
Telephone Main 5000

THE ELECTRIC SERVICE COMPANY

New-Business Department Announcement.

For instance, it was important that all services be connected, if reasonably possible, within twenty-four hours after the application was taken. To do this would require the best co-operative work possible on the part of the salesmen, contract division, credit, construction, inspection and meter departments.

The construction and meter departments and meter readers were provided with pads of blank card forms on which could be noted name and address of possible "prospects" for lighting or power business.


Manager New Business Department
One Young Man Stenographer
Contract Division 2 men 1 lady
Publicity Division 1 man
Lighting
Commercial Lighting 2 men
Residence District 5 men
Appliances and Vehicle Charging 1 man
Power Division 3 men

The manager of the company realized that the general unattractiveness and location of the company's offices on a side street were not in keeping with the up-to-date policy of the company. Therefore, offices were secured on one of the main streets. The show windows and a portion of the front office space necessary for three or four tables was devoted to displaying heating devices and small current-consuming appliances. A portion of the lobby was devoted to the comfort and convenience of the public. This space was covered with rugs and furnished with comfortable chairs, window seat, palms and table with telephone connection, writing material, blank checks, etc.

Next in prominence was the new-business department, with space for the contract division of the department, located as accessible to the public as was the cashier's cage.

Contract Division.

The contract division was in charge of two men and a young lady typist who also had charge of the electric appliance display while the appliance or vehicle specialist was not in the office. The young men (one a typist) were selected from employees of the old company on account of their large acquaintance, tact, patience, and ability to please, which, coupled with gentlemanliness and a good address, is essential in men for a position of this kind, for it is at the application and adjustment counters that the public forms impressions of the company; therefore, it was extremely important to have the proper representatives in charge, and provided with up-to-date maps showing the location of the company's distributing lines. Fifty per cent of the number of applications for service were expected to come to the company "over the counter"; however, the most desirable and profitable business in a situation like at Powerfield must necessarily be first worked up and contracts closed by expert commercial sales engineers.

Publicity Division.

Fortunately the services of a young man were secured who had made a local success of newspaper reporting and selling advertising space. He was known and respected by a large number of the leading citizens of Powerfield. Being a live wire, this man soon developed a good knowledge of the lighting and power business and rendered valuable assistance through the preparation of appropriate copy for regular and special advertising, and in down town sales work. The accompanying ad is a sample.

The newspapers were ready to insert his interesting news items concerning the progress made in popularizing the use of electricity in Powerfield because

the company was a regular advertiser and because the company was bound to be a big factor in the upbuilding of the city. A booklet and letters announcing the company's rates, policy, rules and regulations pertaining to obtaining service, etc., were prepared and distributed. These helped to familiarize the people with a business that heretofore they had considered as entirely technical. Such booklets as "Home Thoughts Electric," "Electricity in Our House," "Electric Progress Magazine," "The Silk Cord," and the large number of excellent folders, leaflets, blotters, etc., gotten out by the various manufacturing companies were distributed to carefully selected prospects from time to time as occasion and special campaigns required. During the time that the company's bills were distributed by messengers, they were accompanied by flyers furnished by electric manufacturing companies describing various electrical conveniences for the home; later, when the postal card system of billing was used, the postal was made double so that the extra portion would be convenient to return to the company or contractor as an order for the device advertised upon it. The getting up of direct-by-mail advertising, letter forms and mailing lists from card files, etc., were the obvious duties of the publicity man, and in addition giving as much attention as possible to sales work down town in closing contracts for service.

It was deemed advisable to advertise only in a very limited way in theater programs, church bulletins, etc., and place advertising where it would be most effective. Illuminated billboard advertising features were worked out and placed where they were viewed day and night by large numbers of people.

Commercial Lighting Division.

One of the two men in this division of the new-business department was secured from an electric sign-manufacturing company. He was a man with artistic instincts sufficiently prominent to sketch original designs for signs that appealed to the prospect, and a clever salesman who realized that to sell signs one must often first create the desire for advertising before the sign can be sold. This man soon acquired the latest information on commercial lighting and illuminating engineering practice from one of the lamp factory training schools and from representatives of manufacturers of lighting units and reflectors. The assistance of specialists sent out by manufacturers was appreciated by the company, for they co-operated with the new-business manager in actual work in closing contracts, making layouts for illumination, power, etc.

The second man in this division was a former representative of an electric lamp company, of marked sales ability, a young man well adapted to take up commercial lighting work in Powerfield where there was need for the exercise of special ability in factory lighting and in properly arranging the illumination for large department stores, hotels and office buildings.

Residence District Lighting Division.

The residence and outlying districts and communities on the outskirts of Powerfield were divided between five salesmen, all employed at moderate salaries, three of whom were graduates of the Chicago Central Station Institute and the other two having been employed by the old company who were retained. A sixth man; formerly a heating device specialist, was employed to specialize on electric-vehicle charging and the sale of all small current-consuming and special heating devices outside of the regular residence districts.

Each salesman was carefully instructed in the use, construction and usefulness of all current consuming devices. The assistance of the electric appliance or vehicle specialist was available should a district man need help. The training and instruction of these salesmen were taken up almost daily and personally by the manager of the department. It was essential that even the men who were experienced in central-station sales work should be taught to carry on their work in accordance with the department mana-

Name _____ Date _____ Card No. _____

Address _____ Motor Installation by _____

Business _____ Is Installation Eff. _____

Supt. or Mgr. _____ Individual Group Drive _____ Running Hrs. Week Month _____

REMARKS

	Kw. Hrs.	Kw. Max.	NET BILL		Kw. Hrs.	Kw. Max.	NET BILL		Kw. Hrs.	Kw. Max.	NET BILL	
JAN.												
FEB.												
MARCH												
APRIL												
MAY												
JUNE												
JULY												
AUG.												
SEPT.												
OCT.												
NOV.												
DEC.												
TOTAL												
AVERAGE												

Total H. P. Installed _____ Av. Cost per Mo. per H. P. Installed _____ Load Factor _____

Remarks _____

Front Side of Customers' Power-Data Card.

LIST OF MOTORS AND MACHINES DRIVEN

GM 11-8-10 FORM 32

H. P.	Volts	Speed	AC or DC	Make	DRIVE		METHOD OF DRIVE				FOR DRIVING
					Indvl.	Group	Direct	Belt	Gear	Chain	

REMARKS

Back of Power-Data Card.

ger's own ideas; hence the necessity for spending considerable time for the first few months in general and special training work. The greater portion of the electric-vehicle specialist's time was spent about town in an effort to install heating appliances for industrial purposes, in restaurants, stores, factories, ovens in bakeries, irons in tailor shops, irons and hot rolls, etc., in laundries, as well as small motor applications of all kinds, including washing machines, stationary and portable vacuum cleaners and ozonators.

Electric Vehicles.

The appliance or vehicle specialist was sent to the factories of several large electric-vehicle concerns manufacturing both pleasure vehicles and trucks in order that he might properly handle the business of selling service for charging and to a limited extent give customers free inspection service. The electric-vehicle business in Powerfield, as in many other cities, had been neglected, or in fact never started, and

PROSPECTIVE POWER,

COMPANY KIND OF BUSINESS

MANAGEMENT

LOCATION REPORT BY DATE

EQUIPMENT: ENGINE DIMENS H.P. R.P.M. BOILER H.P.

PRESENT CONDITION CONTEMPLATED CHANGES

(EXHAUST) (LIVE) STEAM USED FOR

OPERATING EXPENSE: FUEL (TONS AND PRICE)

OPERATION: THE FOLLOWING DATA IS TAKEN FROM (TESTS) (ESTIMATES)

AVERAGE LOAD (DAY) (NIGHT) K.W.H. PER MONTH

HOURS OF OPERATION

ANNUAL REVENUE AT

EQUIPMENT AND CONNECTED LOAD, PROSPECTIVE

PROPOSAL SUBMITTED, DATE

Card for Prospective Power Customers' Data.

being a business of extreme importance to central stations, the manager left no stone unturned in his efforts to have several agencies established in Powerfield, the agents arranging to have sales representatives from the company that each represented visit Powerfield and actually canvass the field. The Electric Service Company co-operated with these agents and sales representatives in every possible way. The result was very gratifying to all concerned.

It should be explained here that it was the policy of the company to only sell heating devices or appliances at retail from the company's stock in special or emergency cases. The dealers and contractors were encouraged and assisted in every way by the specialist to build up a large and profitable business. The company kept on display several types of irons, toasters, percolators, vacuum cleaners and small motor applications, selecting the appliances that it was believed, after careful practical test, were the devices that would best "stay sold," keep in good repair and give satisfaction to customers. The company co-operated with the contractors and dealers by turning their salesmen's orders over to them, the company, however, regulating and establishing uniform resale prices for appliances.

Record Cards.

The card file system was followed in keeping new-business department records. Properly printed forms for the purpose of collecting information were carried by each salesman and a complete record of present and prospective residence customers was obtained as rapidly as possible. Each salesman on one day of the week until the record was complete, would work exclusively on record cards, visiting all houses wired or unwired upon present lines. Through the same system of records, contractors reported changes and additions to the company's lines, thus making it possible to keep the connected-load record fairly accurate.

A system of records for power was gradually brought up to date, covering all power consumers. These record cards furnished the information for accurate statements by letter or in person to consumers who brought complaints; the power data cards were particularly valuable in that the whole story appeared, including kilowatt-hours used by months for a considerable period of time. The record cards were kept without employing additional labor, as each salesman was held responsible for the data from each customer or "prospect" in his territory, and the daily records were recorded by the contract division employees and new-business department manager's stenographer. These record files were constantly referred to by the adjustment department and others as occasion arose.

Power Division.

For the development of the company's business, the increase in net revenue and improved load-factor, power business in Powerfield was the most important and profitable prospective business. It was difficult to obtain a first-class, evenly balanced power salesman or commercial power engineer. After a careful search a chief power man was finally found. He was a technical school man with three years' experience in the testing department and school of salesmanship of one of the large apparatus manufacturers, and later with actual experience in selling central-station power service. This man was first of all a salesman, secondly, an engineer. Another power man of less experience was taken on on account of his apparent ability as a salesman, with the idea of training him in Powerfield, and a third experienced power salesman was taken on temporarily.

The manager of the department and the chief power man first observed that it was impossible to *guess* how much prospective power business there was and at what rate it could be obtained; therefore, it was decided to make a "Power Market Report." The report, when completed, showed that there was approximately 35,000 horsepower in steam power or approximately 25,000 horsepower in prospective connected electric motor power. From careful consideration of this report and present power business, but primarily upon the relative cost of service, a new power rate schedule was made up, based upon the demand that the customer imposed upon the company's station, plus a scale of charges for current consumed. Such a rate will usually be competitive under ordinary conditions with the cost of steam power. As negotiations were taken up with each power prospect a brief report of the test, if made, with comparison of operating costs using central-station service was submitted. One of the accompanying illustrations shows the card on which this information is tabulated.

General.

The organization of the new-business department at Powerfield having been completed, the author will touch upon the general plan of the company to keep all employees informed as to the progress made by the company, hold their interest and instill a feeling of loyalty and personal interest in the advancement of the company's interests. Each evening meeting was in charge of some one department manager. The educational feature was of a popular nature; for instance, the pulmotor squad would respond to a false alarm and demonstrate resuscitation upon a volunteer. Sales papers, talks, lantern-slide exhibits, illustrations of effective advertising, and discussions were indulged in, thus creating interest and enthusiasm in the work of each department, at the same time educating all employees along lines that would result in benefit to the company as well as to the employee personally.

A straight salary was paid to the new-business department employees, for it was considered impracticable to use the commission or salary and commission plan in a city the size of Powerfield. During campaigns, however, prizes were occasionally offered for the largest amount of business secured.

The new-business manager arranged his office hours so as to spend much of his time in active outside sales

NAME OF CUSTOMER (CONTRACT MUST ACTUALLY BE SIGNED)	NUMBER OF LIGHTS *	LTG. LOAD 60 WATT EQUIV.	LTG. LOAD K. W. EQUIV.	POWER LOAD H. P.	POWER LOAD K. W.	SUNDRY APPLIANCES	K. W. EQUIV. OF SUNDRIES
TOTAL							

DATE_____

*REGARDLESS OF KIND OR SIZE

_____
NEW BUSINESS SOLICITOR

Daily Report of New Business.

work, for he realized that the place for salesmen was out in the "Field."

Special Campaigns.

The best way to follow the intensive business-getting methods of the Electric Service Company during the first year is through noting a few of their campaigns.

Old-House Wiring Campaign.

A special house-wiring campaign was started in an effort to connect up houses wired but not taking current, and those not wired, located upon the company's lines, including houses located in territories for which extensions had been approved subject to the signing up of sufficient business.

The resultant wiring business was divided among the electrical contractors who desired to share in the business at the prices. The prices included a flat-iron at practically cost to the company. This fall campaign was very successful. It was put on in the fall because wiring contractors were least busy then and the temporarily reduced prices would "hurt their business" the least, besides the company gained long-hour lighting customers through the winter months and absolutely new business, for the majority of these old houses would never have been wired or connected if it had not been for the special campaign.

Letters were sent out to people living in houses not wired and located upon or near to present or proposed lines. The salesmen followed these up with excellent results.

POWER ACCOUNT

ITEMS CHARGEABLE TO ISOLATED PLANTS.

OPERATING EXPENSES	Isolated Plant Cost		Cost with Central Station Service	
*Superintendence				
Wages....Engineers and....Engine Attendants				
Wages....Firemen and... Coal Passers				
Fuel, ...tons @.....per ton				
Car Demurrage				
10% shrinkage in Fuel, account of weather and transportation from mines				
Cost of Removing Ashes				
Water for Boiler.....Gals @.....per M gal.				
Cost of Boiler Compound				
Repairs to Engines				
Repairs to Boilers				
Maintenance and Cleaning of Boilers				
Repairs to Dynamos				
Maintenance & Repair Costs on D. C. Motors				
Repairs and Maintenance of Belts				
Repairs to Steam Elevators				
Repairs to Hydraulic Elevators				
Repairs to Electric Elevators				
Repairs to Steam or air lift pumps and Miscellaneous Machinery				
Cost of Changes in Piping, Pipe Supplies etc.				
Tool Account				
Incandescent Lamp Renewals				
Arc Lamp Carbons				
Arc Lamp Globes				
Arc Lamp Repairs				
Miscellaneous Expense, Oil, Waste, Packing, etc				
Cost of Break-down Service Purchased				
Value of Time Lost Account Failure of Isolated Plant Power				
Cost.....K. W. Hours C. S. Service				
TOTAL ACCOUNT, Operating Expenses				
FIXED CHARGES				
Interest on Power Plant Investment at 5%				
Depreciation on Plant Investment at 8% Motors 5%				
Ins. and Taxes on Power Plant and Bldg. 2% of Valuation, $				
Rental Value and Space Occupied by Plant				
Decreased Rental Value of Space Made Less Desirable by Heat of Plant in Summer, and Vibration				
Risk of Damage to Employes and Public through Accidents and Boiler Explosions				
TOTAL ACCOUNT, Fixed Charges				
TOTAL COST For Maintaining Plant for.....Months.	TOTAL		TOTAL	
TOTAL SAVING BY PURCHASING CENTRAL STATION POWER			SAVING	

*By "Superintendence" we mean the time of the head of the firm, or his principal assistant—high-priced men—who look after the purchases for the plant, watch its economy, and in many other ways devote time to it. If relieved of these duties, their time would earn you in other directions a large return.

Power-Account Card.

Sign Campaigns.

The commercial lighting division, having sized up the sign situation in Powerfield, and finding very few good signs then installed, obtained approval of a plan to furnish sign service at a flat price per lamp per month to customers on a three-year contract, without the customer incurring any capital expense. Through assistance from sign-company experts contracts for nearly 200 signs were closed in a few months, all signs to burn on a dusk to midnight schedule every night. Many of these signs were large National advertiser's signs, thus brightening up the city and stimulating downtown business materially.

Some excellent outline-lighting business was closed after the company set the example by outlining the front of the building it occupied and erected a roof sign reading:

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:.....:
: WHY USE ELECTRIC SERVICE? :
:    ASK OUR CUSTOMERS      :
:.....:
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Good window lighting received a stimulus when the publicity man had a few photographs taken of the best examples of window lighting in the city and reproduced them in the newspapers, withholding the names of merchants.

A curb lighting or white way system was proposed by the Powerfield Booster Club. The result was a long-term contract with the city for the Service Company, covering furnishing of current and renewals.

Commercial Lighting.

The commercial lighting business could not be handled on a campaign basis but the progress made by the new-business department in improving the lighting in downtown stores in Powerfield and in displacing other forms of illumination was very profitable to the company and gratifying to the management.

Power Campaign.

Through persistent effort and the exercise of good salesmanship and tact, the connected power load of the company was doubled and the station load curve took on a different appearance. The power salesmen and the manager

were greatly assisted in their work by having reliable data on the great variety of power installations given in the Electrical Salesman's Handbook of the National Electric Light Association Commercial Section and from data that had appeared in the articles on power requirements in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN.

At a meeting of the directors of the Electric Service Company of Powerfield one year after the new-business department was inaugurated, it was unanimously declared that the department had been the principal factor in the success of the company during the year, not only because of the new business and the creation of new demands for electricity in Powerfield, but because of the benefit to the company's business in having intelligent and trained men come in daily contact with the public in the community served, and the new-business department was established as an important and permanent institution.

It was found that the total expense of the new-business department for the year was 2.7 per cent of the gross revenue, which was entirely satisfactory to the directors of the company. It was pointed out that if the company had deemed it wise to have freely sold appliances, the net profit on merchandise sales would have served to cut the new-business expense 20 to 30 per cent. It, however, was decided to continue co-operating with dealers and contractors and distribute appliances through them, and from displays at drug stores, etc.

The one year's work of the new-business department and the company as a whole woke up the people of Powerfield to the realization that "live-wire" business men were in their midst —men whom they were glad to meet and chat with on the streets, at their clubs and at their offices, not simply because they were congenial gentlemen, but because they represented an important industry; i. e., a modern utility company in their city, a corporation that had a soul, a company that, aside from a pardonable amount of selfish interest, had the interest of the city and its inhabitants at heart, and because it had made good.

It is needless to say that the Electric Service Company of Powerfield had the confidence of the public. It had been and was daily living up to its promises in giving everybody a square deal and the best possible service in every way that it was possible to serve. The money it took in as net profit—far larger in amount than the old company ever had—won praise rather than criticism. Why? Because modern and intensive business-getting methods, which necessarily include a properly organized and maintained new-business department, had been used.

Some Tendencies in Electric Lighting.

Some thirty years ago when central-station service had its birth and for many years during its infancy its sole activity was the supply of electrical energy for lighting. The evolution of the industry has been so rapid that other activities have in some instances dwarfed the relative importance of electric lighting, but it remains and is bound to remain one of the most vital products of central-station supply. It is desirable, therefore, when the country's leading central-station men are gathering for the discussion of their problems and achievements, to make a general survey of the present status and tendencies of the lighting art.

As a rule, electrical men are too engrossed in the further development of the industry to spend much time in complimenting themselves on what they have already achieved. Extraordinary as the developments of the past thirty years doubtless are, they are regarded in a matter-of-fact way. Nevertheless, the electrification of all branches of lighting has advanced so rapidly in these short years that it is appropriate cause for gratification. Electric lighting has outdistanced all of its competitors. The very aggressiveness, boldness and speed of its advance have, however, in many quarters brought neglect of important considerations. These are becoming recognized and through the ingenuity of the lighting fraternity means are being brought forth for rectification. One of the objects of these general comments will be to point out some of these features.

Street Lighting.

The oldest branch of electric lighting is that of lighting streets by means of arc lamps. Many central-station systems of present large magnitude had their origin as arc street-lighting plants. This early use of arc lamps for this purpose accounts, in fact, for the persistency of their employment in street lighting. Having set the vogue, they are still preferred in many instances where other electric lamps are doubtless more suitable.

At the outset of this discussion it should be pointed out that there are two conflicting tendencies in street lighting, both of which are based on more or less plausible arguments.

On the one hand are those who contend that the streets of every city can be divided into various groups, three or more, depending on their relative lighting requirements, both from the standpoint of density of vehicular and pedestrian traffic and of necessity of protection from crime. Thus, in the first group are the principal business streets in which there is considerable street-car and automobile traffic and much promenading on the sidewalks; for the sake of safety from the traffic alone such streets require a much higher degree of illumination than any other streets in the community. In the second group may be placed the lesser business streets and those in districts that are almost exclusively given over to wholesale houses, warehouses, factories, etc.; here there is much less traffic and perhaps after six p. m. very little traffic, but police requirements, at least, call for ample light to permit the ready detection of prowlers; a somewhat lower illumination than for the first group suffices. The third group includes principally residence streets in which the presence of shade trees complicates the problem; a relatively low illumination is required, but this should be quite uniform so that a person can readily find any house he is looking for. The foregoing classifications are only general; they vary in different communities, for example, a small town having only a few business and nearly all residence streets, whereas a metropolitan city has even more than three distinctive types of streets from the lighting standpoint, besides parks and boulevards, with their special requirements. Now it is contended, especially in a large community where the requirements are so different, that the street-lighting equipment be designed to suit the particular requirements of each class of streets, that the type of lamp, its height and manner of mounting, the spacing and general arrangement be such as is particularly adaptable for the conditions prevailing. This contention is based on the well-known fact that no type of lamp or manner of installation is suitable for all the varying conditions met with and each of the modern efficient types has inherent advantages that adapt it best for certain locations. Among those who hold to this view are lighting experts who have devoted years of study to all aspects of street-lighting problems and how these have been met most successfully both here and abroad.

On the other hand, it is contended, principally by those municipal authorities who have charge of street lighting, that the appropriations available for this purpose are nearly always far below what they should be and, therefore, to make them reach as far as pos-

sible the simplest kind of efficient equipment must be used and should be standardized throughout the community. By this plan the lowest investment, operating and maintenance charges are incurred and there is secured that uniformity of appearance of lamps and posts that is so desirable throughout a city. There is much of truth in these contentions. By adopting a standard equipment installation and operation, as well as the purchase, storing and replacement of renewal parts are greatly simplified. This standardization may be carried too far, however, as in the case where flaming-arc lamps are placed in residence districts, the undesirability of which practice will be pointed out further on. Admitting the advantages of using a standard type of lamp and post throughout a city, if one suitable for all conditions can be secured, it is doubtful whether the zeal for standardization will be likely to admit such a spacing and arrangement of units as will provide truly adequate lighting in streets of the first class.

Probably the only type of equipment that permits standardization of design and adaptability to practically all requirements, is the tungsten system. A standard type of post of more or less ornamental design can be adopted, which is equipped with a single lamp at the top in residence streets, with two additional brackets (making a three-lamp cluster) in secondary business streets, and with four brackets to form a five-lamp unit in the principal business streets. This will give a very pleasing effect with uniformity of spacing and general design and at the same time provide sufficient light for each kind of street. Moreover, being a convertible system, it will permit providing additional light as the character of the street changes and demands higher illumination. At first blush such a system would seem to involve prohibitive initial expense, but a simple yet dignified design of post, whether of cast iron, sheet steel or reinforced concrete, can be produced at quite reasonable cost and the cost of the underground system, if steel-armored cable is laid without ducts in the stretch of lawn between curb and sidewalk or in the subsidewalk space, or if a conduit can be installed without repaving, is also moderate. Yet, despite these advantages, such a system has the drawbacks that it requires a fairly liberally disposed community and is not so well adapted to a very large city because the high illumination required for many of its streets can be more economically obtained by another unit.

For the metropolitan city it is being recognized that the flaming-carbon-arc lamp has a peculiar field of usefulness. The new series, alternating-current, white-flame, vertical-carbon, long-burning lamp is a great advance over all its predecessors in the arc-lamp line. Its efficiency is very high, its color good, its distribution satisfactory; it is a steady, compact, high-power lamp that is particularly suitable for the strong illumination required for streets with very dense traffic and where there is a considerable number of conflicting and confusing lights. Visitors to the National Electric Light Association convention will find that Chicago is in the van in the use of this type of lamp, over 8,000 being employed on its streets and the city being committed to the policy of installing some 15,000 more of them in the near future. When first installed these lamps were placed too low, thus producing objectionable glare and nonuniformity of illumination. As now being remounted they are placed at a standard height of 25 feet, unless physical obstructions prevent, in which case a denser inclosing globe is employed. As thus installed the lighting is quite satisfactory on secondary streets, although the average spacing of 250 feet does not provide sufficient lamps on the main business streets. The policy of using flaming-arc lamps for distinctively residence streets, which is being followed in quite a few Chicago wards, is not to be regarded as desirable practice. Being placed high, they throw too much light into second and third-story windows; their light is obstructed by tree branches casting deep shadows on the ground; the overhead circuits supplying them interfere with trees. What is needed in such districts is a less powerful unit more closely spaced. Fortunately series tungsten lamps of any desired candlepower are available for this purpose and they are coming into increasing use. In the drawn-wire type they can now be procured in more uniform quality than heretofore so that such great care in selecting lamps of identically same carrying capacity is not needed.

No mention has been made respecting the use of other types of street arc lamps. The older lamps, such as the open and inclosed carbon arcs, have seen the best of their days and are rapidly being retired to museums of the obsoletes and to the scrap pile. The metallic-flame-arc lamp is still giving satisfactory service, but is not regarded favorably in places where its use would require the installation of special rectifying apparatus, since the alternating-current flame arc already referred to is providing superior service in many respects and with very simple substation equipment. The quartz-tube mercury-arc lamp has during the past year been tried out for street lighting on a small scale in this country with excellent results as far as efficiency of operation, low maintenance and good light distribution are concerned. Being unsuited for alternating current in its present form it has the objection already urged against the magnetic arc and besides this its color is not regarded favorably by many.

A new development regarding the placing of street lamps is the discovery that when lamps are spaced at considerable intervals of, say, one to a block it is found easier to drive in the roadway with the lamps all on one side of the street than with the more usual staggered arrangement on both sides of the street. This, of course, is not startling when it is remembered that in very small towns or in the suburbs of cities series incandescent lighting with brackets all on one side is commonly in vogue with fairly good results. In large cities its use on third-class streets permits considerable economy of installation and consequently the extension of electric lighting to less built up districts that otherwise would have to wait for it some time.

The foregoing random discussion has considered street lighting only from the standpoint of municipal service that a community is obligated to provide for all of its streets. Municipalities are prone to make this service the minimum possible that will be tolerated and are particularly reluctant about providing more light than police requirements absolutely demand. Some of the consequences have already been alluded to, as the inadequate lighting of the most important business streets and the alternate bright and dingy spots on all streets due to the too general use of high-power units at remote points. Business property bears a higher percentage of taxation per front foot than does factory or residence property and equitably should receive more municipal service of every kind. But if the merchant wants more and better street lighting for its mercantile value, he is almost invariably compelled to provide for it at his own expense. Many business streets have had good lighting systems installed at private cost with the sanction of the city but without its real co-operation. In many cases the old city lamps are even still left in to spoil the effect, it would seem. This unjust special burden on the merchants shows itself in those who believe they cannot afford any additional expense for extra street lighting and refuse to enter into any improvement scheme; the result is that the lamps are provided only here and there before the premises of actual contributors and the uniformity of spacing so desired for its impressive effect is entirely spoiled; still worse, when a merchant moves out and his successor refuses to pay the monthly lighting charge the lamps are cut out

of service and removed with the globes, leaving only the ghastly skeleton of the equipment and a blemish instead of ornament to the street.

An instance of fairly good co-operation of city with property owners can be seen on the main part of Dearborn Street, Chicago, a description of which was given in these columns in the issue of April 12, 1913. This shows incidentally the use of trolley poles for combination light and railway service so as to avoid encumbering the street with a multiplicity of poles. A very striking instance wherein a municipal body installed a fine modern system of lighting without any expense to the abutting property owners, aside from general taxation, is the highly ornamental tungsten-cluster installation on Michigan and Jackson Boulevards in the heart of Chicago. The ornamental posts used in this case are quite expensive, which makes the installation still more anomalous, but sets an example worthy of being more generally followed.

Outline, Sign and Window Lighting.

Other branches of outdoor lighting that have been found to have considerable commercial value are outline lighting of stores or entire buildings and the use of electric signs. If a building has a distinctive architectural design representing considerable additional outlay in its construction, the beauty of this design should be displayed at night as well as by day. To do this on an appropriate scale requires very special equipment in nearly all cases and the expense thereby involved results usually in less successful efforts. A fine example of what may be achieved by a well considered and specially designed equipment is the exterior lighting of the Buffalo General Electric Company's building, a description of which was given in our issue of December 14, 1912. The ordinary outline lighting cannot compare with such a display, but still when artistically laid out, outline lighting has considerable possibilities and should at least be employed on the headquarters of the central-station company. At some future time when public funds are more generously and judiciously spent, we may expect to see our most important public buildings permanently illuminated on the outside, instead of only on very rare special festivals as is now the case.

Since the object of an electric sign is purely advertising, it is the opinion of many that the more strikingly attention-commanding that the sign is, the more successful is its use. This seems to involve the idea of some moving spectacular display, although a sign of the spelling or word-building type is sure to be noted. It is true that an artistic stationary sign will even draw considerable attention, if placed where it is readily seen. The need of a striking display depends largely on the proximity of other signs. Where these abound originality of design and action is imperative. Arrangements can now be made with sign companies whereby changeability of the announcement is provided for as frequently as desired. This permits calling attention to things in season and greatly increases the advertising value of a sign. By means of color caps or hoods placed on the lamps the appearance of the sign can be materially changed also. In all signs it is imperative to look after maintenance closely. Replacing of burned-out lamps and cleaning are especially needed to keep up a legible and neat appearance of the sign. Neglect of these features defeats the purpose of the sign.

Intermediate between exterior and interior lighting, because its effect is viewed entirely from the outside, may be placed the lighting of store windows. Only one or two features of this need be emphasized. The chief one is the need of placing the lamps completely out of the range of view of the observer. The best place to put the lamps is along the upper edge of the window close to the front, they being provided with efficient reflectors to direct the light down upon the goods and against the rear screen of the window, if it has one. What is wanted in a window is the illumination of the objects displayed therein and not a row or groups of bright lamps whose glare will blind the person so that he cannot see anything else. Fortunately the better class of stores and all wide-awake merchants are appreciating this evident requirement and it is a pleasure to go along a business street in the evening and view the attractive shop windows. Window trimming has been developed to be quite an art in which much study has been given to attractive arrangement of goods, contrast between background and display and appropriate lighting. But there are still to be seen too many windows with brilliant border lamps and other lamps promiscuously placed with the mistaken notion that people should view the lamps and nothing else.

Interior Lighting.

No problem of lighting is a simple problem, but of all lighting problems the most difficult of truly successful solution is the design and layout of an interior lighting installation. If this fact could be made so emphatic as to carry conviction to the readers of these crude comments, sufficient will have been accomplished to make further remarks on the general subject of interior lighting unnecessary. There is a false notion quite prevalent on the part of many architects, central-station men, contractors and others, that all that is needed is to know the floor area of a room, multiply it by a certain figure, say one watt per square foot, and the result is the total wattage that must be provided in the form of any size lamps, arrangement of units and type of fixture that seems to suit the fancy of the estimator. Such an empirical method has the advantage of simplicity only and occasionally the results are not bad through mere chance. In only too many instances, however, insufficient or no consideration has been given to the peculiar conditions prevailing, such as the shape and height of the room, the color of its ceiling, walls and furnishings, the use of the room or the work to be done in it, the avoidance of glare and fatigue of the eyes from too much or improperly directed light, the artistic effect produced, and other considerations.

Empirical rules, valuable though they may be in many cases, cannot be followed blindly without at least occasional disastrous results. Even lighting experts or illuminating engineers are often perplexed in deciding what equipment is best for a certain installation and how it should be arranged. The folly of using rule-of-thumb methods without sufficient study is, therefore, at once apparent. The moral of this discussion is evidently that every organization responsible for the design of lighting installations must have specialists to conduct this work. Were it not that expert, even though not entirely disinterested, aid may be freely had from the engineering departments of the manufacturers of lamps, reflectors and shades, fixtures and other lighting accessories, conditions would be even worse.

However, there is no reason for despair because a hopeful tendency for betterment has already manifested itself in several ways. One of these is the growing use of indirect and semi-indirect lighting. The public is beginning to realize that the indiscriminate use of brilliant light sources produces most objectionable glare and that by the use of various types of indirect equipment this is almost wholly obviated. There is a little danger that the popularity of indirect lighting may cause its use in places where its use is not particularly suitable; this error, if anything, however, is in the right direction and is not very serious.

Another manifestation that is favorable is the increasing use of opal shades and diffusing globes to reduce the glare from direct light sources. An increasing number of efficient prismatic and mirrored glass reflectors and of metal

reflectors in commercial and industrial installations permits placing the lamps high up out of the range of ordinary vision and directing their light down in an unobjectionable way upon the work in hand. If lamps must be hung low, a deep opaque reflector should be used. Great care must also be exercised that only lamps and reflectors designed for use with each other are used; too large or too small a lamp will not give the results anticipated.

The preceding paragraphs have been written as a note of caution to be observed in connection with a very auspicious movement that is rapidly gaining strength and which may be designated, for want of a better term, as the complete "tungstenization" of all interior lighting. A tremendous impetus was given this tungsten movement by the introduction of the drawn-wire tungsten filament and a still greater impetus is already evident in the extension by some progressive central stations of the policy of free lamp renewals to include at least the larger tungsten lamps. Much headway has already been attained in the tungstenization of office, store and theater lighting and strenuous efforts are being similarly and successfully directed to factory lighting. But as yet relatively little use of tungsten lamps has been made in residences. It is a good sign, therefore, to see a concerted effort about to be made to greatly extend the use of these lamps in the home. For residents who are already central-station customers this will mean increased use of current for other purposes with attendant improvement of load-factor and greater sale of appliances. For those who do not yet receive central-station service it means a strong inducement to equip the house electrically, thus providing work for the wiring contractor, business for the seller of things electrical and means for connecting practically every house to the distributing circuits. In other words, tungstenization is the entering wedge to further electrification.

In connection with the much more general use of tungsten lamps a further precaution is necessary. This refers to the choice of lamps of proper voltage. Many central stations have made no extensive or accurate voltage surveys of their distributing systems, depending more or less on calculation of what the actual voltage at the customers' premises is. The result in most cases is that tungsten lamps are burned at less than medium or even at bottom voltage and the full advantages of their use are not realized. This is not as it should be; the useful life of the lamps at top voltage is great enough to make their use at this voltage more than pay. Their contrast to carbon lamps at lower voltages is not so pronounced and will not make so strong an appeal. Use of the lamps at top voltage emphasizes the need for careful shading, which otherwise would not be so apparent.

Space does not permit touching on more phases of the extremely broad field of interior lighting. Before closing, however, a plea must be made for the avoidance of too much sameness in neighboring installations. This is particularly objectionable in residences and stores. In such cases appearance is very important and as great an appeal to the artistic instinct should be made as is consistent with the outlay that may be incurred. Competitive stores especially require distinctiveness and individuality in their lighting equipment as in other things. The great variety of fixtures, glassware and other lighting appurtenances now available on the market should permit of equal diversity in the actual installations.

These random comments have been limited to only a few high-spot features of electric lighting. If they have seemed to be critical, it must be remembered they were prepared in the spirit of friendly criticism which always acts as a boost.

The Commonwealth Edison Company.

Chicago Central Station Leads the World in Producing and Selling Electrical Energy.

Chicago—the "Electrical City"—in welcoming the delegates and visitors to the annual convention of the National Electric Light Association, points with pride to its central-station company, an organization which stands pre-eminently for the greatest development of electricity supply in the world. The Commonwealth Edison Company is first in the total capacity of its generating equipment, first in the breadth of the development of its market for the sale of electricity, first in the total output of energy, and first, also, in the actual number of customers supplied. While it may be difficult to grasp the significance of these facts, the reasons for this high degree of development are easily ascertainable. It has been due, in a large measure, to the persistent advocacy of the central-station idea, and, what is still more important, to the truly heroic policy of planning and constructing power plants on such a large scale and of such advanced design that energy can be generated by them more cheaply than by any possible competitor. The officers of the company frankly state their belief that the generation of electrical energy is a natural monopoly and that it is properly subject to rate regulation by commission.

The present company is the successor of several smaller companies, chief among which was the old Chicago Edison Company, whose territory included the business center of the city. That company commenced business on April 29, 1887, and the quarter century which has been passed was appropriately observed in Chicago on April 29, 1912, when Samuel Insull, who has been president of the Commonwealth Edison Company and its principal predecessor, the Chicago Edison Company, since 1892, addressed a gathering of some 2,500 employees, his subject being "Twenty-five Years of Central-Station Development in Chicago."

The first stage of development consisted in introducing central-station electric service to the people of Chicago, and the gradual building up of the generating and distributing system, from a small start to what was considered at the time to be a splendid culmination; the erection of the power house at Harrison Street and the Chicago River.

The Adams Street Station, the original generating station of the company, was first operated on the system on August 6, 1888, and shut down permanently August 19, 1894. The original equipment consisted of four 200-horsepower Armington & Sims engines, each driving two No. 32 Edison bi-polar machines with a capacity of about 80 kilowatts each. The second station to be constructed was that known as the Twenty-seventh Street station, this plant being built to serve a local community. The North Clark Street Station which was next erected, was the first in which vertical engines with direct-connected dynamos were installed. The Harrison Street Station at the time of its construction was considered one of the most celebrated stations for producing electric energy in the country.

In those days, 1892, the connected load amounted to about 88,000 50-watt incandescent lamps, 1,826 horsepower in motors, 2,320 series arc lamps, and 1,095 low-tension arc lamps on meter service, the total equivalent being 155,000 50-watt lamps, or approximately 10,500 horsepower. Compared with present figures, these seem small indeed.

The rates for various classes of service were comparatively, and unavoidably,

high. Electric power was regarded as expensive and consequently isolated plants flourished in great numbers. But in spite of this situation, meaning as it did, serious competition, the business of the company steadily increased. Believing that the principle of central-station service was fundamentally sound, aggressive selling methods were inaugurated and concentrated efforts made to demonstrate the superiority of the service, with the result that the volume of business, as well as the connected load, increased 100 per cent from 1891 to 1892, and 65 per cent from 1892 to 1893.

From 1892 to 1903 the wonderful interconnected system of principal and subsidiary power houses, for which the Chicago central-station interests became famous, as they were readily world pioneers in all of this development, was built up and transformed from a widely differentiated equipment inherited from various small companies to a homogenuous system each part of which was able to depend upon or assist another part as conditions required.

Aside from the sale of electricity for industrial power and commercial lighting a great deal of work was done by the well-organized new-business department in introducing electric light into the average home in the great residential districts of the city. Many houses were wired for the use of electric light and in a short while a notable improvement was effected. The connected load of the two companies, Chicago Edison and Commonwealth Electric, increased rapidly until, in 1900, it was seen that a still bolder course of physical development of the central-station system, providing for more universal application of its output, would be justified.

With characteristic courage and foresight the great Fisk Street power station was projected and planned in the fall of 1903, and the first 5,000-kilowatt Curtis vertical steam-turbogenerator in the world installed there and put into service. It is of particular interest to note that steam-turbine generating units are now used exclusively in each of the three great stations of the company and that the development of large and economical steam-turbine units was coincident with the electric power development in Chicago.

The deliberate abandonment of the reciprocating type of engine, involving in this case an investment of millions of dollars in a type of machinery that was practically unknown in the stress of commercial service, was a truly heroic undertaking, the successful conclusion of which has been amply demonstrated. The first 5,000-kilowatt unit was put into commercial service on October 2, 1903, and this was followed by two more of the same size, and one of 7,500 kilowatts capacity; then six units having a continuous rating of 12,000 kilowatts were installed and the four original units replaced with four 12,000-kilowatt units, making a total of 10 units all alike and aggregating 120,000 kilowatts. The Quarry Street station was found to be necessary long before the Fisk Street plant had been completed. This latter station was equipped with six 14,000 kilowatt units and the Northwest station was next constructed.

Fisk Street Station.

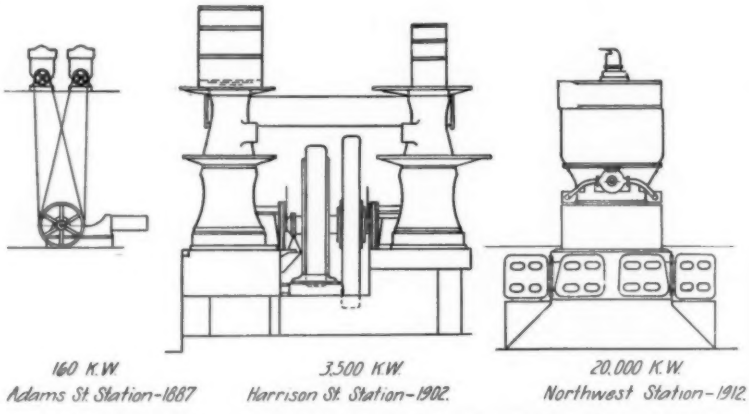
The Fisk Street station consists of three buildings: a boiler house and turbine house under one roof, and the switch house, a smaller building located parallel to but 50 feet from the main building. The station is located between two slips on the north side of the south branch of the Chicago River. The very large volume of condensing water is thus easily taken in on the up-stream side and discharged on the down-stream side of the river.

The total ground area on which this station is located is 16.5 acres on which is laid 2.5 miles of single track railroad for the storage and handling of coal in cars. Ten cars can be placed in the train space at the end of the boiler room in the station at one time. The tracks traverse a series of receiving hoppers leading to an individual motor-driven coal presser and coal conveyor apparatus for each boiler section. Immediately overhead are large ash bunkers from which the empty coal cars receive their accummulation. The overhead coal bunkers aggregate 12,000 tons for the 10 units, or 80 boilers.

The eight boilers of each battery are placed in a row opposite and at right angles to a line through the center of the turbine room. Each boiler has 5,200 square feet of water-heating surface, is of the double-drum type, and equipped with a superheater. Boiler pressure is 180 pounds and 150 degrees superheat is secured. Chain-grate stokers are used.

The steam turbine units are all of the same design, being five-stage machines running at 750 revolutions per minute. The bucket wheels have two rows of blades each. The excitation of the turbogenerators is supplied by six motor-driven and four steam-driven exciters supplemented by three storage batteries, all so connected that the excitation system may be operated in three independent sections. There are two control galleries in the turbine room, one for seven units and the other at present serving only three units, but when the station is fully developed each will serve seven units.

The high-tension switching equipment is all in an entirely separate building located 50 feet from the power house, the two being connected by means of two underground passageways. The high-tension leads from the generators, as well as all the control and instrument wiring, is thoroughly isolated in separate groups of underground conduit. The high-tension busbars are all located in the basement. The oil switches are on the first floor, while on the second floor are located two of the excitation storage batteries, general offices, assembly room, electric kitchen, dining room, etc.



Graphic Comparisons of Size of Generating Units Used by Edison Company.

Switching and busbar equipment are provided for eight outgoing underground lines for each of the 10 units, arranged on what is known as two-bus systems. There is a total of 155 oil switches in this station, those used for generators, busbar ties and for groups of four feeders are rated at 1,000 amperes, while the oil switches on individual switches are rated at 300 amperes. Great care has been used in isolating and arranging the lines leaving the station, all of which are placed underground in a carefully planned conduit system.

Quarry Street Station.

On October 7, 1907, one month after the consolidation of the Chicago Edison Company with the Commonwealth Electric Company, under the corporate name of Commonwealth Edison Company, ground was broken for the Quarry Street

station on a nine-acre tract located just across the river from the Fisk Street property.

The general arrangement differs somewhat from Fisk Street in several features, as the ground occupied is narrower for its length. There is only one building, which includes train shed, boiler section, turbine room and switch house.

There are six vertical steam turbogenerators of 14,000 kilowatts sustained maximum capacity each, arranged in one row in the turbine room on 42-foot centers, as the boilers are in two longitudinal rows running parallel with the turbine room. Four units generate 9,000 volt, 25-cycle and two are 12,000 volt, 60-cycle machines.

Electrically, the station is divided into two separate sections. One contains four 25-cycle units and their auxiliaries and the other contains two 60-cycle units. In a bay off the turbine room there is installed a very large frequency changer, 5,000 kilowatts, which operates as a link between the 25-cycle and 60-cycle system.

An important feature in this station is the ventilating and cooling system provided for the generators. The south part of the basement under the turbine room is a free space open at the west side of the building and leading from this space to the top of each turbine the large metal duct. Small metal blades, mounted around the top of the rotor so as to act as propellers, force a strong current of cool air drawn from this basement passage down through the generator and out into the turbine room through the opening in the lower part of the armature shell, preventing heat radiation from the top of the steam section of the turbine from affecting the coils above.

Each turbine takes 48,000 cubic feet of air per minute. This ventilating is an essential feature in operating these large units at full load, especially in warm weather.

While the mechanical features of the coal-handling system and the firing room are similar in detail, the general plan differs from that of Fisk street in that there are two main sections instead of separate sections for each unit. There is the same type of train shed but the coal is carried to two large crushers by two bucket conveyors running under the tracks, and thence by separate cross conveyors of the belt type to four other longitudinal bucket conveyors, one for each row of boilers in the west half and another for each of the two rows in the east half of the boiler house portion of the station.

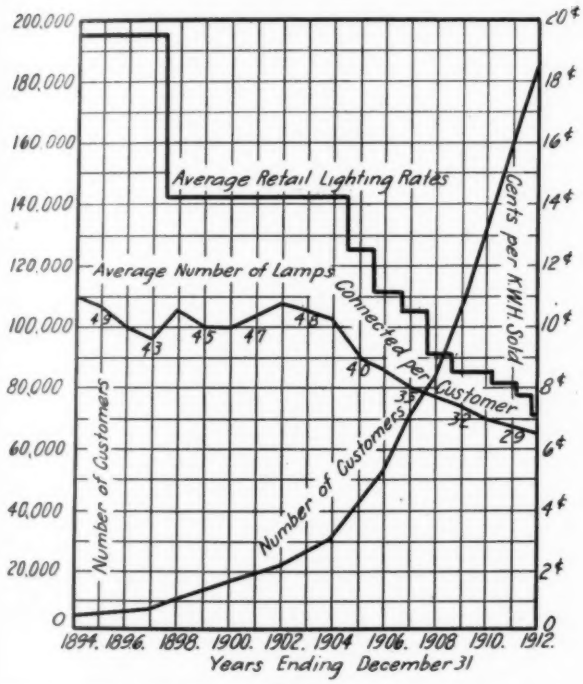
There are three 150-kilowatt direct current generators driven by steam turbines for supplying exciting current to the six turbine units, and in addition to this there are two motor-driven 150-kilowatt exciters, and also two storage batteries of ample capacity for emergency use. The steam-driven exciters supply pairs of turbines in the principal division, while the motor-driven exciters are reserved apparatus. As a further source of supply, the Twenty-second Street substation and a local substation have direct-current connections to the exciter bus.

The main control board is located in the operating gallery which is built out from the first floor of the switch house portion of the station, extending slightly within the turbine room overlooking the units.

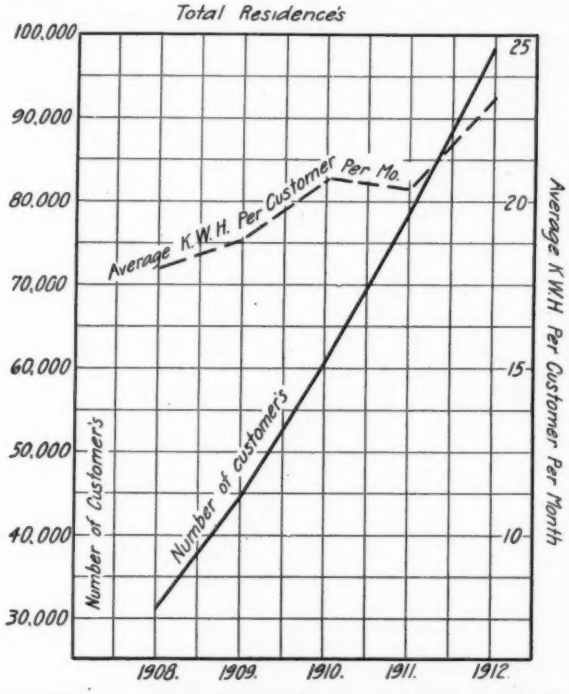
Six 250,000-circular-mil cables, three of which are placed in each of two private tunnels under the river, connect this station with the Fisk Street power house for mutual support to the equivalent of one unit.

Northwest Station.

The enormous equipment installed in the Fisk and Quarry Street stations, matched by the simultaneous development of the entire distributing and transmission system, was the direct outcome of the large plans of the men who directed central-station enterprise in Chicago. Their object was to supply not merely light and power requirements for private concerns, factories, office buildings and homes, but also to lay a very broad foundation for the operation of these enormous power houses on the most highly economical basis by entering into long-term contracts with local transportation companies for the supply of their large requirements of energy for the operation of surface and elevated traction systems. All this has been successfully brought about, and, of course, increased the demand for additional capacity, to such an extent that the Northwest station, greater than either of the other two, was built. Ground was broken



Curve Showing Reduction in Rates, Lamps per Customer and Number of Customers.



Curve Showing Average Consumption per Customer per Month and Number of Customers.

October 7, 1910, and at present two units of 20,000 kilowatts capacity each are installed.

It is interesting to note that in this station will be housed what will be the largest unit in the world producing electrical energy—a 30,000-kilowatt turbo-generator. This unit will be delivered about July 1, 1914. It has an overall length of 60.5 feet, is 18 feet 4 inches wide and 14 feet high. The generator will be a 9,000-volt, 25-cycle three-phase machine with two poles, operated at a speed of 1,500 revolutions per minute, and designed for an output of 1,925 amperes per phase. The turbine will be operated at a steam pressure of 230 pounds with a supertemperature of 200 degrees Fahrenheit. The entire unit will weigh about 500 tons.

The Northwest station is located on the east portion of a large tract comprising 110 acres, consisting of two principal areas of about 60 and 50 acres, connected by a strip 125 feet wide. The whole property is bounded on the extreme west by Kimball Avenue, on the east by the north branch of the Chicago River, on the north by Addison Street, and on the south by Roscoe Street. The cable distance from the center of the city is about six miles and that from Fisk and Quarry Street stations about eight miles.

The general plan of the power house is similar to that of Fisk Street. There are 10 triple-drum boilers for each unit, arranged in a row perpendicular to the longitudinal axis of the turbine room. The heating surface of each boiler is 5,600 square feet. The steam pressure is 250 pounds, with 150 degrees superheat. There is a brick-lined steel stack of 17 feet internal diameter for each 10 boilers. These stacks rise 250 feet above the boiler room floor, which is 36 feet above city datum and is also 21 feet higher than the turbine room floor. The basement of the boiler house contains the machinery for the oiling system.

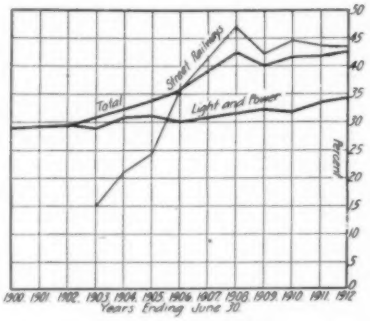
The station is coaled from the Northwestern Railroad over a private elevated railroad entering the grounds from the west. Including the switchback there will be over three miles of this track eventually. It is operated by the Commonwealth Edison Company with its own electric locomotives using the third-rail system at 600 volts.

In the boiler-house basement running centrally beneath each two rows of boilers, are four railroad tracks for handling the ashes and coal. The station bunkers have a total capacity of approximately 1,400 tons for each unit of ten boilers. The coal storage on the grounds will eventually be able to accommodate 250,000 tons.

In the turbine room the two units now installed generate three-phase, 25-cycle, alternating current at 4,500 volts, the pressure being raised to 9,000 volts by three 3,333 kilovolt-ampere auto-transformers for each unit. Ultimately the station will contain some 60-cycle machinery. The ventilating system employed at Quarry Street is duplicated at Northwest station.

The steam-driven auxiliaries are also located in the turbine room. There are four 300-kilowatt steam-driven exciters, and two 200-kilowatt motor-driven exciters to be installed when the ultimate equipment of six units is installed. There is also ample storage-battery capacity for emergency excitation and station lighting.

Directly east of and parallel with the turbine room is a separate one-story building known as the transformer house, in which the three 3,333 kilovolt-ampere auto transformers for each of the two 20,000-kilowatt generators are installed.



Annual Load-Factors.

Each of these transformers contains 1,700 gallons of oil, and is water-cooled with a flow of 16.5 gallons per minute. A separate compartment is provided for each. This building also contains the oil pumps, the neutral oil switches and the neutral busbars. South of it is a 3,500-gallon underground oil tank into which oil from the transformers may be drained in emergency.

The switch house at Northwest station is also a separate building, containing three floors and like the transformer house to which it is adjacent and is connected, its long axis parallels that of the turbine room. On the first floor are the high-tension buses, instrument transformers and the bells of the outgoing transmission lines. The second floor contains the oil pots of the oil switches, their operating mechanism being on the floor above. There are 19 of these for each unit, nine of them being line switches, eight group and tie switches, and two generator switches.

Transmission System.

There are three separate parts in the system of high-tension transmission lines connecting the generating station with the 53 substations from which distribution is accomplished.

The most important of the three is the 9,000-volt, 25-cycle system which carries by far the largest portion of the generated output, supplying all of the company's substations and also the railway substations. It consists of some 450 miles of high-tension cable extending north to Evanston and south to Hammond, Ind. The lines radiating from Fisk Street supply the north and west territory and those from Quarry Street the south side of the city chiefly, including the traction substations.

The long range portion of the 25-cycle system is operated at 20,000 volts, and is derived from the 9,000-volt system through three 5,000-kilowatt transformers. It consists of four lines, two supplying Grand Crossing, South Chicago, Roseland and Hammond, and two extending to Evanston where they connect with the systems of the Public Service Company of Northern Illinois and the Chicago & Milwaukee Electric Railway.

The third portion is the 12,000-volt, 60-cycle system. Previous to 1910, a portion of the 60-cycle, 4,000-volt distribution system supplying some large industrial power customers, had been fed from the 9,000-volt, 25-cycle transmission system through frequency changes. The load increased to something like 27,000 kilowatts and consequently the two 60-cycle generating units at Quarry Street were installed and the 12,000-volt transmission system inaugurated. All told, there are 130 transmission lines with a total length of approximately 525 miles.

The demand for large amounts of current at a distance greater than 10 miles from the station has caused the creation of a 20,000-volt system to furnish energy to distant points. This energy is transmitted direct to the outlying substations. This outside distribution is accomplished through the sale of electrical energy by the Commonwealth Edison Company to the North Shore Electric Company and the Economy Light & Power Company, the last named at Joliet, Ill., both now component parts of the new consolidated company known as the Public Service Company of Northern Illinois.

Substations.

There are connected with the Commonwealth Edison Company's system 40 substations owned and used exclusively for its distributing network, 23 exclusively for railroad service and five combination substations built to contain apparatus for both ordinary and railway service. Most of these substations are large distributing centers occupying handsome buildings. There are three used exclusively for storage batteries. At the Market Street substation where the building is used in part for offices a storage battery of the new Exide type, built especially for central-station work has been installed. With the exception of New

York, this is the first battery of this type to be installed for central-station service. The Market Street substation, it may be added, comprises a handsome edifice of eight stories with a frontage of 190 feet and extending back to the Chicago River at the south 183 feet, and at the north 156 feet.

Distribution System.

The Commonwealth Edison Company employs direct-current for distribution in the central portion of Chicago, and three-phase, 60-cycle, alternating-current in the other sections.

The low-tension direct-current system covers an area of about 10 square miles in the congested downtown district. This system is supplied from 22 rotary convertor substations, 13 of which have auxiliary batteries, three exclusive battery substations and one direct-current generating station at Harrison Street. The standard sizes for feeders in this territory are 1,000,000 circular mils, and 1,500,000 circular mils capacity. These feeders connect with an intricate network of direct-current mains at various points, the whole system being tied together at street intersections.

The three-phase 60-cycle system which covers a far more extensive territory, is not thus interconnected, but consists of separate four-wire circuits with open emergency centers for tying-in in case of trouble. It radiates from and is supplied by 10 substations with 2,000-4,000 volts on the primaries, the service pressure being stepped down to 115-230 volts by line transformers installed where required.

Summarizing, the total capacity of Fisk Street station at present is 180,000 horsepower, while the additions at present under construction will bring this figure up to 247,500 horsepower. The capacity of Quarry Street is 126,000 horsepower, and that of Northwest station 60,000 horsepower, which figure will be increased by 45,000 horsepower when the new unit is installed. The total capacity of rotary converters installed on the Edison system is 72,000 kilowatts. The total capacity of frequency changers and step-down transformers for the 60-cycle substations, 65,000 kilowatts. The battery capacity for one hour is 22,200 kilowatts.

The accompanying Tables I and II, give a summary of transmission and general data.

TABLE I—TRANSMISSION LINE DATA.

		9,000 v.	12,000 v.	20,000 v.
Number of Direct Lines.	From Fisk St. Station	56	.....	4
	From Quarry St. Station	25	17	.....
	From Harrison St. Station	9	.....	.....
	From Northwest Station	16	.....	.....
Number of Tie Lines		24	4	5
Average Length of Tie Lines		1.3 mi.	2.4 mi.	3.2 mi.
No. of Company Substations Supplied		29	13	5
No. of Railway Substations Supplied		18	.....	2
Average Length of Direct Lines		3.6 mi.	4.2 mi.	12.5 mi.
C. M. Capacity		No. 4-0 and 250,000 cm.	No. 4-0 and 250,000 cm.	No. 2-0
Average Maximum Load Per Line, Company (winter months)		2,000 kw.	2,500 kw.	Combined 3,800 kw.
Average Maximum Load Per Line, Railway (winter months)		2,200 kw.	.....	
Total Maximum Load (Non-Coincident)		155,000 kw. (Inc. transformers on 20,000 v. system)	23,900 kw.	In luded in 9,000-volt load

TABLE II—MISCELLANEOUS DATA.

Number of buildings occupied wholly or partially	49
Number of electric generating plants	4
Number of substations for distributing current	40
Total capacity of generating equipment	130,000 K. W.
Number of storage batteries ready for emergencies	15 stations
Capacity of storage batteries at ½-hour rate	28,000 K. W., or 38,000 horsepower
Distributing systems	Edison 3 wire, and 60-cycle, 3-phase, 4-wire system
Voltage	115-230
Horsepower in motors connected (exclusive of railway)	215,972
Lighting load connected (16 candle power equivalent)	4,730,946
Total connected (equivalent in 16-c. p. lamps)	10,904,686
Connected load—general business	413,434 K. W.
Connected load—railway business	131,798 K. W.
Miles of transmission lines	280
Miles of main and feeders, underground	325
Miles of ducts, underground conduit	1,700
Miles of overhead line wire	3,950

DETAIL DATA—FISK STREET, QUARRY STREET AND NORTHWEST STATIONS.

	Fisk Street	Quarry Street	Northwest
Ground First Broken	6-25-02	10-7-07	10-7-10
Units First Put Into Service:			
Unit Number 1. Old	10-2-03	10-29-08	.....
Unit Number 2. Old	12-11-03	11-28-08	.....
Unit Number 3. Old	4-21-04	7-19-09	.....
Unit Number 4. Old	10-27-05	7-23-10	.....
Unit Number 5	9-19-06	8-10-10	.....
Unit Number 6	10-10-06	9-15-10	.....
Unit Number 7	11-13-06	.....	.....
Unit Number 8	1-22-07	.....	.....
Unit Number 9	7-19-07	.....	.....
Unit Number 10	9-22-07	.....	.....
Ultimate No. Units on Property as per Present Plan	14	6	12
Maximum Capacity of Such Units	12,000 kw.	14,000 kw.	20,000 kw.
Present Capacity of Stations	120,000 kw.	84,000 kw.	40,000 kw.
Ultimate Capacity of Stations	168,000 kw.	84,000 kw.	240,000 kw.
Ground Area for Plant, Tracks, etc.	16½ acres	9½ acres	109 acres
Single Track Mileage of Tracks on Company Real Estate	2½ approx.	1 approx.	3 miles
Dock Frontage	3,075 ft.	1,450 ft.	1,100 ft.
Length of Main Building (Present)	475 ft.	462 ft. 10 in.	295 ft.
Width of Main Building (Present)	240 ft.	207 ft. 10 in.	276 ft.
Length of Switch House (Present)	340 ft.	462 ft. 10 in.	293 ft.
Width of Switch House (Present)	50 ft.	33 ft. 7 in.	55 ft. 10 in.
Height of Turbo-Generators (With Condensers)	34 ft. 9 in.	33 ft.	35 ft. 7 in.
Diameter of Revolving Turbine Element	11' 8" P. Dia.	11' 8" P. Dia.	13' 6" P. Dia.
Weight of Revolving Parts	75 tons	87 tons	104 tons
Peripheral Speed (Maximum)	30,000 ft. P. M.	30,000 ft.	31,810 ft.
Oil Provision for Each Turbine	25 Gals. P. M.	25 gals.	.....
Double Drum Boilers in Station	80	48	60—3 drum
Water Heating Surface in Each Boiler	5,200 sq. ft.	5,200 sq. ft.	5,600 sq. ft.
Total Water Heating Surface, Boilers Now in Use	400,000 sq. ft.	240,000 sq. ft.	112,000 sq. ft.
Type of Stokers Under Boilers	Chain Grate	Chain Grate	"Bayonne" Ch. Gr.
Rate of Travel	3"-4" P. M.	3"-4½" P. M.	.....
Weight of Each Grate With Carriage	17½ tons	20 tons	30 tons
Boiler Pressure	200 lbs.	225 allowed	250 lbs.
No. of Stacks for Station, Present	1 for 16 Boilers	1 for 6 Boilers	1 for 10 Boilers
No. of Stacks for Station, Ultimate	7	8	6
Height of Stacks Above Boiler Room Floor	259 ft. 6 in.	250 ft.	250 ft.
Inside Diameter of Stacks	18 ft.	12 ft.	17 ft.
Cooling Surface Condenser for Each Turbine	25,000 sq. ft.	25,000 sq. ft.	32,000 sq. ft.
Quantity of Water Pumped for Each Condenser	22,500 gals. P.M.	25,000 gals. P.M.	40,000 gals. P.M.
Coal Burned Per Day	2,000 tons	1,200 tons	2,000 tons,
Coal Reserve	53,000 tons	25,750 tons	6 Units
Men Required to Operate the Station (3 shifts)	325	145	.....

Business Growth—General Statistics.

Brief mention has been made in succeeding paragraphs of the almost phenomenal development of central-station business in Chicago, and the coincident development in generating, transmitting and distributing equipment. Successive reductions in rates and aggressive business-getting methods, together with absolutely fair and impartial dealings throughout its entire history have built up the business at the rate of 1,000,000 50-watt lamps per year, which growth has been maintained for the last three years. Table III indicates graphically the increases that have been made. It will be seen that in 1893 the company served a total of 4,452 customers, while in 1912 the astonishing figure of 182,929 had been reached. It is also interesting to note that at the time of the consolidation of the Chicago Edison and Commonwealth Electric Companies, 8,814 power customers were served, while on December 31, 1912, 15,090 customers, having an aggregate motor load of 215,972 horsepower, were served.

TABLE III—GENERAL STATISTICS.

Years.	Total Number of Customers.	Number of Power Customers.	Number of Lighting Customers.	Total Net 16 C. P. Equivalent Connected (Exclusive of Railway).	Net Connected Power 16 C. P. Equivalent Exclusive of Railway.	Net Connected Light 16 C. P. Equivalent.	Total Connected Load, Including Railway.
1889	.....	.....	.....	21,556	3,510	18,046	.....
1890	.....	.....	.....	43,939	13,875	30,064	.....
1891	.....	.....	.....	78,609	18,870	59,739	.....
1892	.....	.....	.....	155,040	27,390	127,650	.....
1893	4,452	.....	.....	241,655	54,195	187,460	.....
1894	4,645	.....	.....	268,427	63,075	205,352	.....
1895	5,289	.....	.....	315,037	83,415	231,622	.....
1896	6,173	.....	.....	347,791	96,285	250,966	.....
1897	7,333	.....	.....	398,965	113,685	285,280	.....
1898	10,535	.....	.....	600,148	146,250	453,898	.....
1899	13,337	.....	.....	739,681	202,155	534,906	.....
1900	16,063	.....	.....	925,182	332,270	592,912	.....
1901	19,180	.....	.....	1,179,818	379,005	800,813	.....
1902	22,445	.....	.....	1,550,409	556,010	994,399	1,590,409
1903	27,128	.....	.....	1,858,308	697,385	1,160,923	1,938,308
1904	31,817	.....	.....	2,143,417	836,115	1,307,302	2,273,417
1905	42,489	.....	.....	2,561,800	1,003,970	1,557,830	2,827,800
1906	53,716	.....	.....	3,075,284	1,245,790	1,729,494	3,637,284
1907	70,018	8,814	61,204	3,803,737	1,590,385	2,213,352	4,825,737
1908	83,941	9,882	74,059	4,299,528	1,809,420	2,490,108	5,761,528
1909	105,535	11,182	94,353	5,238,861	2,242,485	2,996,376	7,390,861
1910	130,361	12,021	118,340	6,288,684	2,707,168	3,581,516	8,726,684
1911	157,115	13,808	143,307	7,189,328	3,085,294	4,106,034	9,705,328
1912	182,929	15,090	167,839	8,268,686	3,537,740	4,730,946	10,904,686

Table IV goes more into detail regarding the connected load of the company, dividing the power load into motors and battery charging, and showing how the lighting load is divided between incandescent and arc lamps.

Table V shows the total kilowatt-hours generated during a period of years from 1902 to December 31, 1912, and further shows what portion of this output was used by the railway companies.

TABLE V—KILOWATT-HOURS GENERATED.

Year.	Light and Power.	Railway.	Total.
1902	63,082,000	2,574,000	65,656,000
1903	79,136,000	5,792,000	84,928,000
1904	90,789,000	10,125,000	100,914,000
1905	114,030,000	17,168,000	131,198,000
1906	139,197,000	67,053,000	206,250,000
1907	162,082,000	151,149,000	313,231,000
1908	170,967,000	203,013,000	373,980,000
1909	202,431,000	289,056,000	491,487,000
1910	238,075,000	388,391,000	626,466,000
1911	272,753,000	443,428,000	716,181,000
1912	315,111,000	483,566,000	798,677,000

The present rates for electric light and power to the average consumer are practically one-third or less of what they were only twelve years ago. This is shown graphically in one of the curves. The chief engineering elements having to do with the reduction in cost, are (1) high load-factor, (2) reasonably large diversity factor, and (3) the use of large generating units. To these should be added good management, for without this the savings due to the others might easily be dissipated.

Improvement in the load-factor is naturally the slogan of power plant management, and has been given the greatest consideration by the Commonwealth Edison Company. Much of the activity in electric heating, refrigeration, ventilation, sign lighting, vacuum cleaning, etc., may be traced to the desire to develop off-peak load. Specially low prices for energy are offered for off-peak business, because it can be carried with little addition to the operating expense and no addition to the overhead charges.

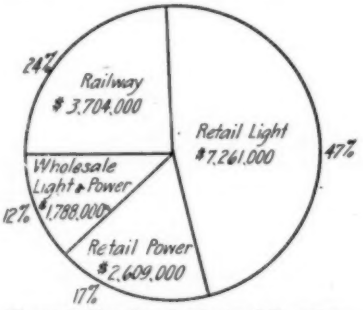


Diagram Showing Analysis of Earnings.

That the Commonwealth Edison Company has been successful in filling in the depressions of the load curve by the policy of supplying cheap energy is evident from one of the curves.

A considerable part of the success in Chicago has been due to the addition of railway load, which has inherently a better load-factor than lighting load. Ten years ago the lighting and power load-factor was about 29 per cent. This has been improved by the addition of industrial power, automobile battery charging, heating, sign lighting, etc., and it shows a tendency to steady improvement due to the increasing use of electric power for purposes other than lighting.

TABLE IV—CONNECTED LOAD.

Years.	Incandescent Lamps (50-Watt Equivalents).	Arcs (Number).	Horse-power of Motors.	Battery Charging, Kilowatts.	Total, Exclusive Railway Load, Kilowatts.	Total, Including Railway Load, Kilowatts.
1903	1,017,457	14,801	44,239	1,670	92,915	96,915
1904	1,152,114	16,088	52,747	2,243	107,171	113,671
1905	1,389,811	17,510	62,814	3,088	128,090	141,390
1906	1,645,562	18,706	77,914	3,854	153,764	181,864
1907	2,019,975	19,879	100,359	4,250	190,187	241,287
1908	2,317,865	17,238	112,860	5,826	214,976	288,076
1909	2,818,398	17,369	139,283	7,662	261,943	369,543
1910	3,418,075	15,935	168,892	9,365	314,434	436,334
1911	3,950,543	14,995	190,887	11,863	359,467	485,267
1912	4,578,786	14,874	215,972	15,772	413,434	545,234

The contract under which the electrical energy is sold to the railway companies is so drawn that there is every incentive for them to keep down their peaks. The readiness to serve charge is $1.25 per month per kilowatt of maximum demand, and the energy charge is 0.4 cent per kilowatt-hour. The maximum demand under this contract is calculated as follows: Three consecutive days are selected from each month, and from the morning and afternoon of each is selected the hour of heaviest load. The sum of the kilowatt-hours consumed during these six hours divided by six is the maximum demand for the month. The three consecutive days are selected so that the kilowatt calculated as above is greater than that calculated from the load line of any other three consecutive days. Under a contract like this the value of properly manipulated storage battery can be readily measured by the control of peaks which it permits. Steam stations operated by the railway company have the same effect and may justify the expense of operating them, although this is doubtful.

Although the railway load has increased by leaps and bounds within the last few years, there has been a steady increase in the retail motor and lighting load. Among these retail customers are the Federal Building, Marshall Field & Company, Carson, Pirie, Scott & Company, The Fair, Rothschild & Company, Siegel, Cooper & Company, The Hub, Chas. A. Stevens & Bro., Butler Brothers, the new Hotel Sherman, almost all of Chicago's leading daily papers, and a large number of great industrial and manufacturing plants, including the Crane Company, Joseph T. Ryerson & Son, Griffen Wheel Company, Ajex Forge Company, South Halsted Street Iron Works, Automatic Electric Company, Mueller & Young Grain Company, Nelson Piano Company, J. B. Clow & Sons, George W. Jackson Company, Western Foundry Company, and the like.

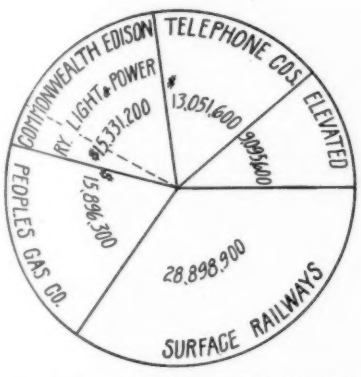
There are also connected to the system a rapidly increasing number of smaller factories and shops of all kinds, stores, schools, churches, hotels, apartment buildings, garages, etc. There has been a wonderful increase in the distinctly residence service, not merely for lighting, but for the miscellaneous domestic purposes that have recently become so popular. The contract department, under the direction of E. W. Lloyd, set a new high mark for 1912 as shown by tables previously referred to.

Land Holdings of the Company.

The land holdings of the Commonwealth Edison Company are decidedly valuable. The headquarters are located at 120 West Adams Street, right in the heart of the best business section of the city. The Edison Building is a handsome

structure of six stories, but is soon to be replaced by what will be the largest building in the world devoted to public utility interests. This new building is now known as the Continental & Commercial National Bank Building but will be vacated by the bank by January of 1914, and remodeled for use by the Edison Company. The Continental & Commercial National Bank Building is at present the second largest building in the city.

In 1908 the Electric Shop was instituted to assist in educating the public to the use of electric service in all its applications in the home, factory and office. This store, located at Jackson and Michigan Boulevards, represents a very large outlay for fixtures and interior decorations and includes a model reception room, dining room, library, kitchen, etc., all completely equipped and arranged to show everything in the way of domestic electrical



Gross Income of Chicago Public Utilities.

appliances to the best advantage. In fact, it is significant that over 2,000 things electrical may be seen at this store. In the basement of the shop are shown motor-driven appliances, lighting fixtures, etc., and there are store rooms and a ware room for small motors. This establishment is doing a large business in the sale of electrical goods, and is patronized by people from surrounding territory as well as Chicago. The beauty of its interior has attracted visitors from all parts of the country.

Policy Toward Public and Employee.

The Commonwealth Edison Company has long been noted for its generous advertising policy which is exemplified by a liberal use of newspaper space. The company was one of the first of the larger central stations to appreciate that fair and honest treatment of customers is essential to success in public-utility operation, and that nothing is lost by taking the public into confidence in all matters.

The broad-gauged policy of the company toward its employees is another feature worthy of mention. There are fine tub and shower baths for the use of power-house employees, and reading rooms and rest rooms in the office building. The employees saving fund is a generous provision for encouraging thrift and affording opportunity for the employee to become a stockholder. The Service Annuity System provides for the payment of substantial sums annually to employees after the retiring age for long and faithful service. All employees are graded and marked on a merit system. There is a well stocked library with several branches located in various company properties.

The company section of the National Electric Light Association is one of the strongest in existence, and every effort is made to offer exceptional opportunities for education both along broad general lines and specifically in connection with the company's business. It has approximately 2,000 members among the men employees. The Electra Club, the organization of the women employees, is more for recreation purposes, although its members participate in many of the advantages of the other organization. In general it may be said that the Commonwealth Edison Company is as much in advance in its public policy toward employees as it is in the material growth which we have briefly outlined.

This almost romantic record was not achieved without the ablest financiering. The company has grown from an initial investment of $500,000 in 1887, to represent an investment of over $80,000,000 at the present time, an increase made necessary to adequately take care of the enormous progress in business from year to year. Some data on the financial situation are given in the accompanying diagrams.

In conclusion this fact should be emphasized—the Commonwealth Edison company supplies one-third more energy to one-third more customers for one-third less dollars per year than any other central-station enterprise in the world.

Baltimore Co-operative Association Formed.

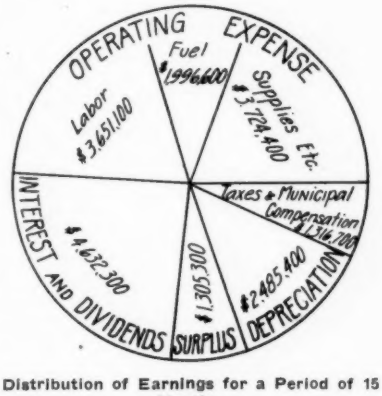
On May 22 a meeting was held at the Builders' Exchange, Baltimore, Md., for the purpose of forming an Electrical Co-operative Association, with the idea of bettering the electrical conditions between central station, jobbers and contractors. The following officers were elected: President, William J. Flannery, of the Baltimore Electrical Supply Company; vice-president, R. F. Bonsall, business manager of the Consolidated Gas, Electric Light & Power Company; secretary and treasurer, Stanley B. Prather.

The charter membership of the association numbered 16.

Rate Research Firmly Established.

About a year ago the Rate Research Committee of the National Electric Light Association started to supply certain members of the Association with current information upon this subject, and soon the need of a regular printed publication was manifested. With the beginning of the second volume of its issues, *Rate Research* was launched as a printed publication. This volume has been completed and contains 420 pages, the last number being a complete classification and index, which renders all of the information contained in this volume readily available. This index is probably the best bibliography of rate regulation information that has been published and should be helpful in preparing briefs upon regulation matters.

The publication has been given a warm welcome and the Committee announces that it is already on a self-



Distribution of Earnings for a Period of 15 Months.

supporting basis, even though it is not published for profit and carries no advertising. It supplements the work of the technical journals in this field by calling attention to important articles appearing in such journals on the subject of rate regulation.

Electrical Credit Association to Meet Next Week.

The fourteenth annual meeting of the National Electrical Credit Association will be held at the University Club, Chicago, Ill., on Wednesday, June 4. The opening session will be at 10 a. m., and will be followed by a luncheon at the club, a meeting of the National Board in the afternoon, an automobile ride through the Chicago park system, and a dinner at one of the clubs in the evening.

Reports will be received from the New England, New York, Philadelphia, Chicago and Pacific Coast Associations.

The president of the association is George J. Murphy, of the Pettingell-Andrews Company, and the secretary is Frederic P. Vose, Marquette Building, Chicago.

The Society for Electrical Development, Incorporated.

By James M. Wakeman.

Co-operation is probably the most overworked word in the English language today. It is applied to all sorts and conditions of business efforts, social efforts and industrial efforts. It has never been better applied, however, than when used in connection with the work of The Society for Electrical Development.

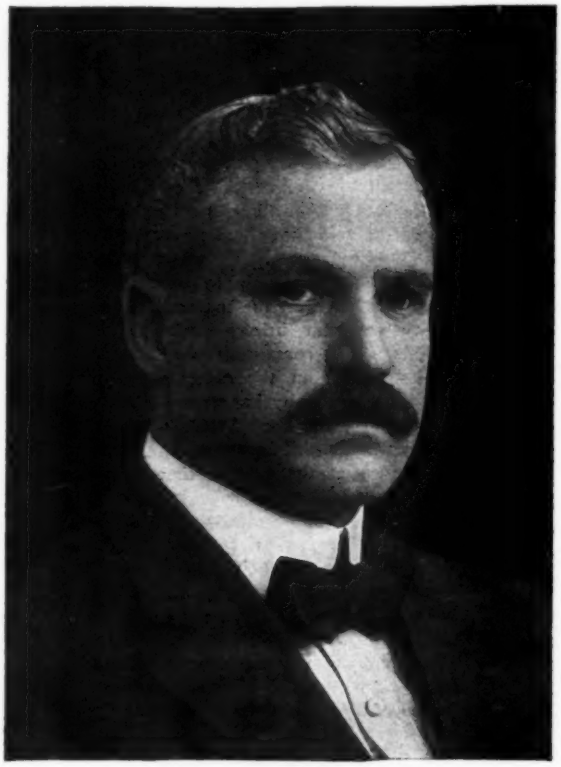
This Society is the result of the expenditure of considerable time, thought and money by a lot of hard-headed business men, who have put it upon a practical working basis. It is planned to accomplish the heretofore difficult problem of the unification of sales effort, added to an educational campaign for the benefit of the various interests that go to make up the electrical industry, and for the ultimate benefit of the public whom they serve.

The whole object is to promote and increase the use by the public of electric current for all purposes, both as an end in itself and as a means of increasing the demand for apparatus and supplies, and the work of the Society is to promote and facilitate a planning and execution of the various means and methods suitable to this end; to encourage the development of the electrical science, art and industry; to develop means and methods tending to promote the welfare of individuals engaged in all branches of the industry; to encourage harmonious relations which will assist in maintaining the industry in the highest confidence of the public; to establish co-operative relations among the different electrical interests, the manufacturers and consumer, so that each may contribute in some measure toward bringing about the result desired by all engaged in the electrical industry.

The membership of the Society as stated in the by-laws, is open to every interest in the electrical industry, and the subscriptions are based upon a small percentage of the gross business, so small, in fact, that it is believed full co-operation can be secured.

The Society has the endorsement of the Executive Committee and the Public Policy Committee of the National Electric Light Association, The National Electrical Supply Jobbers' Association, The National Electrical Contractors' Association and the support of a large number of manufacturers.

A comprehensive idea of the work which can be carried out was submitted in a series of papers at the conference held March 4 and 5 in New York. These suggestions included a national advertising campaign, placing advertising in the general magazines to convince the public of the use of electricity as economical, clean, healthy, safe and convenient, and to demonstrate the various advantages of its use in the home. A campaign in the trade journals setting forth the advantages of electricity in the shops, factories, foundries, etc., and the securing of special articles by well-known writers to be published in the various trade journals, popular magazines and daily papers.



James M. Wakeman,
General Manager, Society for Electrical Development.

The plans also include a business-development department which would engage men to travel and harmonize conflicting interests where troubles exist between central stations, jobbers and contractors, this same department would have a corps of men who would assist central stations in the prosecution of business-getting campaigns.

The Society has already lent aid of this character to a central station, and has a letter from that central station stating that if the Society never does anything more for them than the outlining and practical management of the business-getting campaign they have just inaugurated, the Society has earned the $700 which that central station paid it as a membership subscription to the Society.

Another part of the work will be a department for the preparation of copy used by central stations, contractors, dealers and jobbers in their advertising. There will also be committees appointed to work in harmony with the various other electrical organizations, and it was suggested that an educational department for the purpose of schooling young men in the science and art of salesmanship should be established.

Moving picture films were also suggested; these films to be exhibited throughout the country accompanied by good lecturers and press agents, the object of the films being to demonstrate the use and advantages of electricity in the home.

Traveling electrical shows with competent demonstrators and lecturers. Promotion of the closest possible relations with architects, chambers of commerce, boards of trade and city corporations. Committees to work in harmony with the various other electrical organizations, and other suggestions of this character were made and are today under the consideration of the Executive Committee of the Society.

The character of the men composing the board of directors and Executive Committee assures the successful work of the Society along practical lines. It has at its head Henry L. Doherty, the well known New York banker, and on its Board of Directors and Executive Committee such well known men as A. W. Burchard, of the General Electric Company; L. A. Osborne, of the Westinghouse Electric & Manufacturing Company; Gerard Swope, of the Western Electric Company; W. A. Layman, of the Wagner Electric Manufacturing Company; A. E. Einstein, representing the St. Louis central-station interests; J. E. Montague, representing the Buffalo central-station interests; W. H. Johnson, of the Philadelphia Electric Company; J. F. Gilchrist, of the Commonwealth Edison Company, of Chicago; Ernest Freeman, president of the Na-

tional Electrical Contractors' Association; J. R. Strong, G. M. Sanborn, W. E. Robertson, representing the Electrical Supply Jobbers' Association; F. S. Price, W. W. Low, and other well known electrical men representing the large manufacturing companies, central stations, contractors and jobbers.

The active work of the Society is in the hands of J. M. Wakeman, the general manager, who was for many years president and general manager of the *Electrical World* and vice-president of the *Electric Railway Journal,* and Philip S. Dodd, secretary-treasurer, who was for a number of years assistant general manager of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN.

The great general uses of electrical energy are just becoming recognized. The field of electrical heating and cooking, and the many miscellaneous uses have hardly been touched. The Society for Electrical Development proposes to devote its energy to the kind of work which will make electricity recognized as a necessity, the production of which is to be encouraged and the application of which is to become a necessary part of daily life.

Within the past three weeks a slogan, "Do It Electrically," has been adopted. This, with an official emblem, a keystone with a device setting forth "Economy," "Efficiency," and "Service," will be advertised to such an extent that the phrase and emblem will be familiarized in every part of the country.

The time has come in the electrical industry when universal use is the thing to be sought. The time of destructive competition has fortunately passed and the organization of this Society for united effort in helping the growth of all branches of the electrical business is significant evidence that the men at the head of the Society are men of experience and keen judgment. It will certainly be to the financial and moral advantage of everyone engaged in the manufacture of electrical apparatus, its installation or the sale of current to become members of such a Society, and to co-operate in the work which it is undertaking.

Central-Station Commercial Possibilities.

By H. S. Knowlton.

Expansion is the order of the day in the central-station industry. Its prosperity is independent of any single modern business, and although a recession of trade or a reduction in output in individual lines of commerce and manufacture hold back the maximum development of central-station service, the demand for electricity in practically every field of human interest and endeavor is like the incoming tide of a great world movement overflowing the valleys, mounting the hills of enterprise and penetrating every hidden nook and corner of civilization's working places, quickening into more vigorous life the productive and social processes which are the sustaining activities of this wonderful century. It is characteristic of the central-station industry, however, that it has never been forgetful of the importance of doing its work efficiently so far as the resources in hand have permitted, and that the growth of its business has never blinded its representative managers to the necessity of making economical use of existing facilities of production and distribution. For years some of the best engineering talent of the world has been constantly occupied with the problem of producing electrical energy at the lowest possible unit cost and even the smaller companies have benefited from this work, which is still being continued, but with a recognition today of the larger truth that economical production is a function of increasing output no less than of modern equipment and skilled supervision.

These years of practicing economy in operation have been a splendid preparation for the broad commercial tasks which now occupy so large a share of executive attention and which have drawn so many able and vigorous young men into the central-station industry within the last half decade. If they have sometimes focussed attention for too long a time upon operations within the station, they have on the other hand placed the generating plant in a better position than ever before to carry additional burdens profitably and they have emphasized the economic importance of utilizing the existing investment to the utmost degree possible. The cultivation of the day load, of off-peak business, and the efforts of many companies to secure long-hour and night patronage are the outcome of a wider appreciation of the profits of cutting down the amount of stand-by charges, of the rewards of increasing the output of installed machinery with minimum addition to the investment expense, and of the greater popularization of the service. All these activities tend to improve the shape of the system load curve, which is invaluable as an index of efficient plant use, and whose continued and comparative study deserves the attention of the ablest managers.

The Electric Vehicle.

Foremost among the commercial possibilities of the central station under present conditions moves the electric vehicle, a tool of modern industry and a resource of the pleasure seeker, whose deserved popularity as an efficient mechanism is increasing by leaps and bounds. With many thousands of trucks, delivery wagons and pleasure cars in service today, with large manufacturers and transportation companies ordering machines in entire fleets, and with repeat orders coming in from small users as well as from great concerns who literally look at both sides of a cent before making an appropriation of it toward new equipment, the question of availability is no longer important. The rising price of gasoline, the reduction in wholesale rates for battery charging, the simplicity of the electric vehicle, its remarkable record on the ground of reliable service, freedom from breakdowns and its low cost of repairs, its sustained capacity in the face of adverse weather conditions, its economy of space, diligibility in alleys and congested areas, safety from fire hazards, superior acceleration, minimum stand-by charges, and its working capabilities in comparison with the horse and with the gasoline truck inside its field are powerful factors in its success. The machines of today are far removed in mechanical and electrical design from the earlier products, and yet many of the first equipments are in commercial service and doing good work after more than a decade of hard usage. It is time for the idea that the electric vehicle is in any sense an experiment to be forever cast out of the mind of the central-station manager; room for improvement of course exists as in every human production; but in the face of recent battery guarantees, of improvements in motor design and in transmission, it is not too much to say that the electric vehicle now stands on a plane with the electric motor drive as an outlet for central-station service and as a factor in the economical handling of modern industrial equipment and service. The solid qualities of the electric truck are sufficiently demonstrated by the fact that something like 10,000 of them are now in use and are the products of roughly a dozen makers in direct competition with about 300 manufacturers of gasoline machines.

Like the advent of the electric motor drive, the electric vehicle's appearance and rapid growth in usefulness introduce many important problems for the consideration of the central-station manager, but thanks to the large amount of pioneer

work done in the field the best lines of attack and desirable policies to carry forward are now pretty well determined. The central station must be prepared to provide or stand back of adequate garage facilities, proper charging and a reasonable oversight of batteries, and in a general way serve as the guide, philosopher and friend of the electric-vehicle purchaser in its territory. Every labor-saving device, from a carving knife to a locomotive, requires adequate supervision and care, and the benefits of the electric-vehicle load cannot be had without putting the owner in the way of securing first-class engineering advice in the purchase of his equipment and intelligent handling and maintenance of it after it goes into service. Nothing helps to convince the prospective customer in this line better than an active use of electric vehicles by the central station itself, and it is cause for congratulation that most companies taking up this service appreciate this point.

There is little doubt that it is good policy for the central station to act as the agent of the vehicle manufacturer as a temporary expedient in cases where the exploitation of its territory is inadequate, and the same reasons apply to the inauguration of a battery service under the auspices of the lighting and power company prior to the self-supporting establishment of such facilities by others within its territory. Ultimately, however, the central station will find its best efforts absorbed in the production and sale of electrical energy, and it seems probable that as the use of electric vehicles develops, the provision of facilities for their supply with electricity will exceed the demands upon individual systems for many other services. It is estimated that the substitution of electric trucks, and delivery wagons for all the street haulage in a great city like New York or Chicago would increase the present central-station load by at least 1,000 per cent, and as a large part of the battery charging in modern electric-truck operation is done at night after the lighting peak has passed, it is not unlikely that the time will come when managers will be turning their attention to illumination and day power as off-peak business in comparison with the tremendous charging load which the future seems sure to promise.

Trite as the word has become, co-operation is what is needed between the central station and the manufacturer in order to develop the electric-vehicle load most profitably. The battery makers, motor builders and chassis producers are thoroughly in sympathy, for the most part, with this need. Perhaps a closer mutual understanding between the tire manufacturer and the vehicle maker is the chief present necessity of the situation, aside from a willingness on the part of both the central station and the manufacturer to spend money liberally, but with discrimination in electric-vehicle publicity. It cannot be too strongly emphasized that tires built for gasoline-car service will in many cases give only half the mileage per battery discharge obtainable from tires designed for electric machines. Again, there is great need of spreading among vehicle owners knowledge as to the location of public and private charging stations in the states through which they travel. In the pleasure-car field, in particular, there is a sort of "class" sympathy among owners which is responsive in 99 per cent of the cases to a request for a boosting charge in emergencies, and despite the general feeling that the electric is a car for limited radius work, its touring range is increasing yearly. Taken by and large, the electric-vehicle situation is thoroughly sound at the present time, the growth of the field is enormous, and the possibilities are not easily overestimated when one reflects that at a three-cent rate every truck on central-station service adds from $120 to $360 per year to the revenue, usually at only a trifling expense for charging and auxiliary equipment.

Ice-Making.

The advance of the central station into the ice-making field during the last few years affords one of the most striking examples of the benefits of concentrating utilities under a common management. It is a far cry from the days of the lighting plant with no day load to the modern period of multiplied services furnished by central stations to the communities in which they lead the way toward better methods of living and working. The opportunities in this field are being seized in many parts of the country, and while the South and the Southwest by virtue of climatic conditions will doubtless for a long time afford the most apparent outlet for central-station ice, the successful establishment and operation of plants even in latitudes where the ice crop on the lakes and rivers never fails signifies much to the alert manager. Given the proper engineering investigation and commercial study of local conditions, it is a question if any source of long-hour revenue can be found that offers a more attractive return to the small plant than ice-making and the closely related field of general refrigeration.

Experience in many plants which have taken up the manufacture of ice as a by-product indicates that with a carefully planned installation well handled, artificial ice can be made to compete very closely with the natural product, not seldom in fact being produced at a lower cost than the latter when all the expense of transportation, shrinkage, investment in wagon delivery plant and storage facilities are considered. It seems to be clear now that a large market can be created for artificial ice, once its purity and convenience of production are appreciated by the public. Artificial ice tends to run much more uniform in character than the natural product; it has a high average of excellence in a well managed installation; and as it can be produced as advantageously one summer as the next it is independent of the weather conditions which so often furnish the ice dealer's excuse for a raise in prices at the beginning of the season. Its value as a business from the standpoint of load-factor is apparent at a moment's thought; it calls for energy in inverse ratio to the demands on the system for electric lighting service; and when such work is carried on the 24-hour basis for weeks at a time, it provides the ideal outlet for machinery which would otherwise have to be carried partially or wholly idle with only a potential earning power over protracted periods.

Too much emphasis cannot be laid upon the importance of following competent engineering advice in taking up ice-making as a central-station auxiliary service. Nearly a dozen different types of apparatus must be considered; the character of the existing load in power output, the cost of fuel and of ice storage, amount of water available for cooling, its temperature at different seasons, the presence or absence of condensing equipment, use of raw or distilled water—these and many other points must be investigated and the conditions studied with care in order to solve the problems of selecting the equipment to best advantage and of operating it most efficiently. The selection of the wrong system for the local conditions places heavy financial burdens on the central station or at least cuts down the legitimate profits; whereas on the other hand, with the properly selected equipment, it may often occur that it may earn enough in the months of its harder service to pay handsome dividends upon a large portion of the entire invested capital. Competition is acute between the makers of various ice-manufacturing equipment; but this is no reason for hesitating after receiving independent expert advice to engage in this branch of public service. Long observation of the performance of plants making artificial ice makes it plain that the compression system has its place, sometimes motor-driven and sometimes steam-operated, and that the absorption process has its field, now under live steam operation and again under exhaust steam. Distilled water may be most desirable in one case and raw water in another; both are successful in their respective fields, and neither

has a monopoly of good practice. Raw-water ice may be favored when the supply of sufficient exhaust steam is not available, as in cases where hydroelectric power is at hand, where power is secured from gas engines or from large steam plants of the condensing type located at a distance from the ice plant. On the other hand, with plenty of exhaust steam available for distilled water, the process and equipment are simpler, no agitation being required as in freezing raw water free from impurities.

The problem is largely one of getting the proper equipment in ice-making, combined of course with the question of market development and control. Under favorable conditions even a small plant may produce ice at a cost of from $1.00 to $1.50 per ton. From 40 to 50 kilowatt-hours per ton of ice frozen are commonly sufficient, according to the season and local conditions. In smaller towns where the local market can be gauged with great accuracy, it is generally advisable for the central station to assume control of its ice business from the freezing to its final delivery and billing; but in large cities, there is a field for the supply of energy to local ice-making plants which will take these details off the hands of the central-station company. In the small place the clerical work on the ice sales can be done at little or no extra cost by the force maintained throughout the winter and then occupied largely by lighting and other power considerations.

There is no question that this class of business will expand rapidly in the future, and already it is safe to say that at least from 300 to 400 central stations are engaged in ice-making along lines successful in the greatest majority of instances.

Steam Heating.

The supply of steam-heating service by the central-station systems is another activity demanding adequate technical consideration before its desirability in specific instances can be assured, but given this, large rewards often await the plant prepared to provide district heating in a compact area at meter rates and along lines of construction approved by experience. The electrical and heating-load curves should in a measure coincide, however, in order to avoid the necessity of supplying live steam in considerable amounts instead of utilizing the exhaust of the prime movers for this service. At the outset, it is necessary to make a thorough study of existing loads and equipment, of United States Weather Bureau records, topographical conditions and the probable market for heat on a large scale, with comparisons of non-condensing operating-cost estimates with similar figures bearing upon condensing practice. Five annual conventions of the National District Heating Association have now been held, and the work of that organization in this specialized field of central-station service bears ample testimony that the branch of the industry upon which it rests has an important and increasing influence upon the art of public-utility supply.

The opportunities in this field have been greatly improved of late by the development of better apparatus for steam measurements, by the recognition among operating companies of the importance of adequate records and inspections, by new designs in underground conduit and in heat-insulating materials, and by the bringing forward of steam turbines adapted to the practice of bleeding for the supply of exhaust steam from intermediate turbine stages to the heating mains. Another forward step appears in the movement away from the old and unsatisfactory flat-rate system of charging, with its inability to take proper account of the wide variations in steam consumption among installations in buildings apparently comparable in working conditions. With the rise of metering have come an increased responsibility for frequent inspections and adjustments of meters needing attention, a closer interest in proper initial installations, a broader concern in the efficient use of the delivered heat, and better maintenance of distributing systems.

The introduction of meters from the first has shown a much greater steam consumption at all times than was formerly estimated, and has exposed no small amount of waste, particularly during periods when the outside temperature was such that rooms could be comfortably heated with windows and doors open. Waste of steam in no way benefits the consumer, and is a decided loss and injury to the service company. It overtaxes the heating mains, resulting in an inability to extend the system and secure additional business, and tends to force the heating rates up to a range where the cost of heating to the careful customer exceeds his own cost of heat production and distribution. Hence the use of the meter system has resulted in conserving steam, first by customers' covering piping in locations not requiring heat, second by the weatherstripping of windows, third by keeping doors and windows closed while steam heating is in service, and fourth, by closing flues in grates, utilizing the heat of condensed steam, and in other ways stopping leaks and wastes. The adoption of a meter rate places the service within reach of all, through the use of a sliding scale, and safeguards the profits of the service company at the same time.

These physical improvements and changes in policy are the foundation for a new and vigorous method of attacking the isolated-plant problem, and if they only barely carried themselves financially, they would still be worth while on account of the additional electric service which they often make possible and therefore improve the load conditions. An interesting phase of the problem is the operation by central stations or by specialized organizations, as in Chicago, of decentralized steam heating plants under skilled supervision within limited areas of supply. Such a plan in a large city where a considerable investment already exists has its excellent points, permitting the use of retty low rates on account of the need of no extended distributing network and serving as an entering wedge for scientific management of boiler plants and the introduction of central-station service for power and lighting uses. The outlook at the present time, therefore, in the central-station field, is full of promise, and where analyses indicate the desirability of such service, the equipment and methods of operation now available will go a long way toward insuring the financial returns forecasted in the estimates.

Electric Heating and Cooking.

The advance of the central station into the heating and cooking field is one of the current topics of the industry. Both in domestic and industrial lines electricity is conquering applications of heating service long since regarded as Utopian. The superb accuracy of its control, whether by manual or automatic methods, the improved efficiency and durability of the electric heating apparatus of the present day, and the economical possibilities of such service when designed and supervised by engineers specializing in this important field, mark notable progress over the work of even two or three years ago. The variety of applications of electric heating and cooking which the central station finds ready for exploitation is rich, and yet barely a beginning has been made in the intensive cultivation of this field. The earlier electric heating aparatus sometimes fell short of practical requirements, especially in relation to handling by inexperienced users; but that of today stands on a par in mechanical and electrical stability of construction, flexibility of adaptation and efficiency of operation with the equipment developed in all other branches of the industry.

So wide is this field today that a comprehensive review of it is almost impossible in a limited space. It appeals fundamentally to the central-station manager as a source of long-hour and off-peak business, and in its newer aspects is bound in time to give many other forms of service keen competition. Already electric cooking is cutting into the field of even the largest gas and coal ranges, as in the new building of the Engineers Club of Boston, where a big range of some 30 kilowatts connected load appears to have beaten gas and coal to a standstill. Numerous institutions are now using electric ranges on a large scale and in some of the best city restaurants and college dining halls, the use of this class of service is helping to fill the noon valley in the central-station load curve and cut the cost of production for both the user and the central station as well. In a typical dining-hall installation the inauguration of electric waffle-iron service decreased the amount of dough required, gave lighter and better waffles through the even cooking secured, and actually resulted in a reduction of attendance cost in the kitchen. The increasing popularity of electric toasters, coffee percolators, radiators, flatirons and heating pads, not to mention innumerable other energy-consuming devices in which concentrated heat is required, is in part due to the wise expenditure of money by central stations and manufacturers in business-getting campaigns, but it is probably due most of all to the admirable service which this equipment now gives under the stress of practical use. It is well that central stations are coming to realize that low rates must be offered for successful electric cooking on a considerable scale, and the prevalence of energy charges in the vicinity of 4 and 3 cents per kilowatt-hour is thoroughly gratifying to those who desire to see this branch of the industry grow to its natural proportions. A rate of 2 cents will undoubtedly enable dollar gas to be driven out of the kitchen, particularly if fireless cookers are used where practicable; but there is one very important point about electric cooking which is often entirely overlooked, and that is the fact that the saving in food materials of high cost effected by the electric oven makes the actual cost of energy a secondary consideration in a great many instances. With electric cooking there is virtually no shrinkage in roasting meat, for example, and at present prices a saving of 5 or 10 per cent in weight lost in the gas or coal oven on a 5 or 8-pound roast, makes the question of energy price look pretty small. It should not be forgotten by the central station that in many cases it will pay to sell electric energy for off-peak cooking and heating at prices lower than the average cost of production and distribution on the system as a whole, because the cost of producing the additional energy needed for heating service is generally far less per unit than the cost of generating and distributing the current which goes to intermittent short-hour consumers.

The opportunities for central stations in the field of industrial electric heating are nothing but inspiring at the present time. A large amount of research is now under way in the direction of capturing many small heating applications involving the supply of hot water in more or less limited quantities, and the development of the art along the line of combining long-hour service with heat storage, is not likely to be long delayed. There are many manufacturing processes which are carried on during the night which require the use of heat in the period between midnight and 7 a. m., and as the rates of central stations take these conditions into account and as the wattage yield of the new heating elements goes up per unit of length, large additions will be made to the night loads of operating companies.

One of the manufacturers has lately announced the production on an experimental basis of a wire-type heating element insulated by a thin covering of aluminum oxide and incased in a steel tube of high flexibility, and it appears that the compactness of this material will become invaluable industrially in connection with its high melting point of about 900 degrees centigrade, which is about 200 degrees above the dehydrating point of ordinary mica insulation. In the shoe and bookbinding industries specialized heating devices are driving out steam on a day-load basis from factories long accustomed to employing the older methods; in the research laboratory, in the steel plant, in the hotel, apartment house, club, laundry and innumerable other places electricity is finding increasing applications in directions that a few years ago seemed beyond the dreams of enthusiasts. Looking back a decade hence upon he heating applications of today the fortunate user of central-station service and the far-sighted manager will wonder at the modest developments of 1913 and congratulate himself that out of such beginnings grew a well nigh universal service.

A double-track electric interurban railway is being built between Tokyo and Yokohama, Japan. When completed next year it will be the most up-to-date railway in the Far East.

Advantages of Dussaud "Cold Light" for Moving-Picture Machines.

The so-called "Cold Light" invented by Prof. Dussaud, of Paris, France, which was described in these columns, in the issue of March 29, 1913, has been very successfully employed for the projection lamps of moving-picture displays. It will be recalled that the distinctive feature of this economical light source consists in applying an excess voltage to a tungsten lamp with concentrated filament and by momentarily interrupting the supply many times a second, allowing the lamp to cool in these brief intervals. By gearing the current interrupter to the film reel so that the extinction of the lamp occurs simultaneously with the passage before the lens of the spaces between the individual pictures, the interruption of the light becomes substantially imperceptible and the projections on the screen practically continuous, thus greatly improving the display. It is proposed to light the lamp for the fraction of a second that each picture is at rest and to extinguish it during the time taken for the following picture to take its place. The lamp would thus be lighted about 16 times a second and would remain lighted for three-quarters of each sixteenth of a second and be extinguished for one-quarter. While in service the lamp remains so cool that it may be left against the film without overheating the latter to the ignition point, in this way doing away with the danger of fire ordinarily present. Besides the advantages mentioned, the lamp is highly efficient.

Electric Fire Engines Meet Approval in Milwaukee.

In a recent discussion of the value of electrically operated fire-fighting apparatus, Chief Clancy of the Fire Department of Milwaukee, Wis., is reported to have said "Electricity is an essential factor in fire fighting. Without it in a city of any size the department would be almost useless. The great use of electricity in the department today is in its cutting down of expenses. Electric engines are now taking the place of the heavy steam engines whose cost of maintenance is enormous. The engines of the Milwaukee department, which are kept under steam the year around, consume two tons of coal every month while they are lying in the buildings. I think that in the near future these engines will be superseded by electric-motor-driven pumps. These pumps can be transported to the fire much easier and quicker than the heavy engines we now have. They would greatly cut down the expenses of the department."

Hydroelectric Development of the Mississipi River Power Company.

A Description of the Project at Keokuk.

The idea of hydroelectric projects representing the development of large quantities of power is usually associated with high heads. The largest plant of this type in the world, however, which is located on the Mississippi River at Keokuk, Iowa, uses an average working head of only 34 feet, with a variation from 22 to 39 feet. The work on this project is nearly completed, and it is expected to be ready to supply power some time next month. This development was undertaken by the Mississippi River Power Company, of which Hugh L. Cooper is chief engineer.

As the Mississippi River is a navigable stream, the authority of the United States was necessary before the work could be undertaken and was secured through act of Congress, which stipulated that a lock should be constructed to enable vessels to pass the dam. The dam was built at the foot of the Des Moines Rapids and backs the water up for a distance of about 65 miles, thus creating a lake about 100 square miles in area. The length of the dam, including the power house and lock, is 9,096 feet, the power house comprising about 1,750 feet of this total. The ultimate capacity of the generating station will be 340,000 horsepower, although the equipment now in place represents less than half of this.

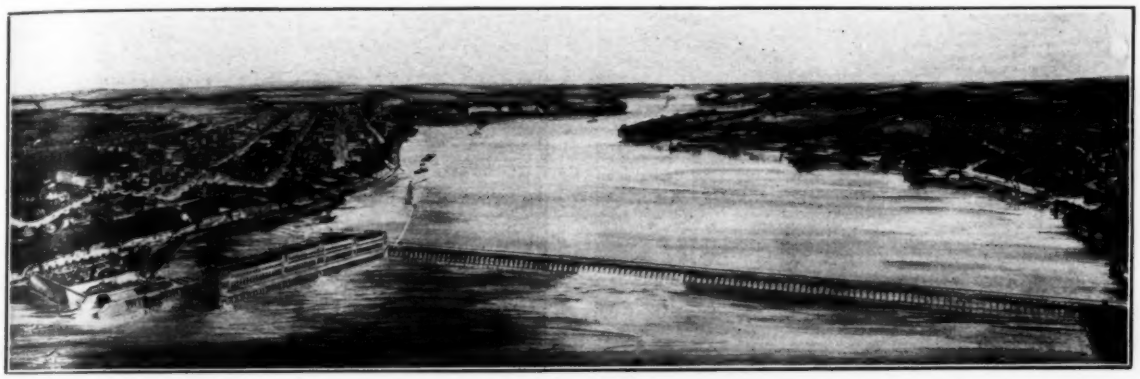


Fig. 1.—General View of Lock, Power House and Dam.

A general view of the dam and power house is shown in Fig. 1. The concrete spillway, 4,570 feet in length, is surmounted by a concrete bridge superstructure, upon which a railroad track has been built, connecting the power house with the Illinois shore. It contains 119 openings, with a clearance of 30 feet each. At times of low water these may be closed by sliding gates 11 feet high and 30 feet wide, built of structural steel. The foundations for the dam are solid limestone. The new lock, which will displace the three former locks and a canal over seven miles long, will have a width between walls of 110 feet and a lift of 39 feet.

The ice fender extends from the west end of the dam along a curved line, meeting the shore at some distance above. It is built of concrete and includes near the end a floating timber boom, which is removed during the season of navigation to permit the entrance of vessels to the forebay.

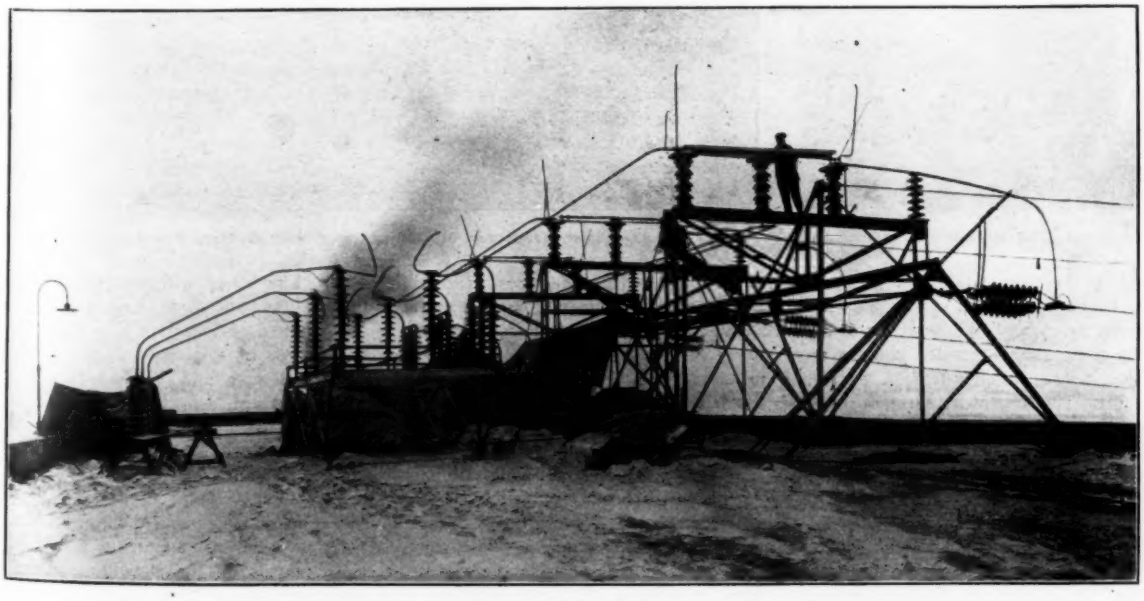


Fig. 2.—Roof of Power House, Showing Line Terminals, Lightning Arresters, Etc.

Power House.

The power house is located between the lock and the river, extending southward from the west end of the dam, as will be evident from Fig. 1. It is a reinforced-concrete building of four stories, 125 feet wide and 894 feet long. The length is divided up into 24-foot bays, of which there are 37. The generator room is located on the river side of the main floor. The transformers are located in central compartments and the screen room extends along the shore side. Narrow mezzanine floors for low-tension switching apparatus run lengthwise through the center of the building. The top floor extends the entire length of the building on the shore side only, except at the ends, where additions are built out over the generator room.

The building is supplied with pipe systems for house-service water, fire-service water, transformer cooling water, transformer oil, oil-switch oil, vacuum for transformer filling and vacuum and compressed air for cleaning purposes.

The power house is lighted by about 1,500 tungsten lamps, mostly equipped with steel reflectors. The lighting system required the installation of about 10 miles of conduit and 25 miles of wire. In addition to this the control wire system required about 30 miles of conduit and 90 miles of wire; the signal system, about 1.5 miles of pipe and 15 miles of wire; the telephone system, about two miles of pipe and 20 miles of wire.

There are to be 30 units of 7,500 kilowatts each in the power house and there are four head-gate piers to each unit, or 120 in all. These extend along the length of the power house facing the shore.

The turbines are of the Francis reaction type and each contains a single runner, this being the first attempt to generate such an amount of power with this design. The diameter of the runner is 15 feet 7 inches and it discharges into a draft tube 18 feet in diameter, gradually expanding in area until at the discharge end it is 22 feet high and 40 feet wide. The tail race is on the river side of the power house and is 2,000 feet long. It is 50 feet wide on the north end and 250 feet wide on the south end, and 22 feet deep. The water will flow out of both the end and the side and spread over the expanse of the river. In all 281,500 cubic yards of solid rock were taken out of the tail race, and the draft-tube excavation adjacent to it. This was more than sufficient for all the concrete work of the power house, lock, dry dock, sea wall and ice fender.

The main shaft of each turbine is 25 inches in diameter, and the weight of the rotating member amounts to a half-million pounds. This weight is carried on a combination truss and roller bearing,

Fig. 3.—Generator Room.

Fig. 4.—High-Tension Room.

Fig. 5.—A 9,000-Kilowatt Transformer.

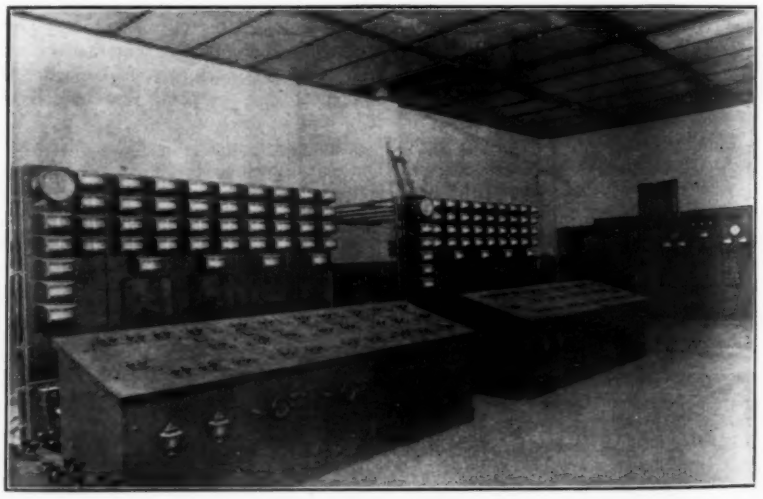


Fig. 6.—Switchboards for St. Louis Lines, with Battery Board at Right.

each of which may be run independently of the other and the load transferred from one to the other automatically.

The turbines were supplied by two different manufacturers, although the designs used by the two differ only in minor details. One manufacturer cast his runner in a single piece weighing about 130,000 pounds, with a diameter of 16.5 feet and a height of 12 feet. The transportation of a piece of this size was a railroad problem, which was solved by building a special car and picking out a special route along which the bridges were high and wide.

The turbines revolve at 57.7 revolutions per minute, the speed being controlled by the manipulation of 20 guide vanes.

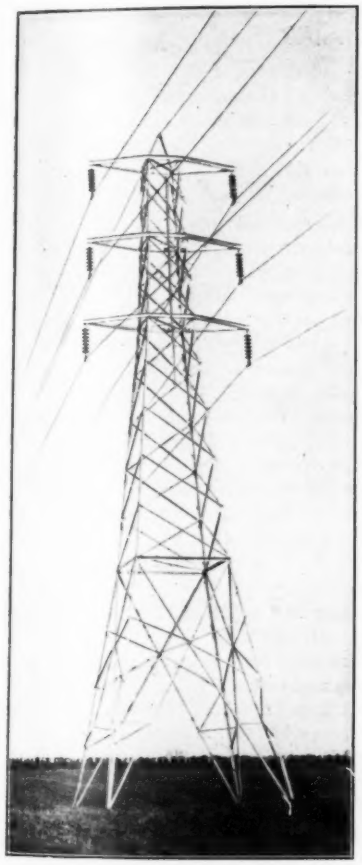


Fig. 7.—Standard Tower.

These guide vanes are operated by two hydraulic cylinders operating under oil pressure through pistons, connecting rods and cranks. The scroll case from which the water enters the buckets is so designed that the water has a uniform speed of about seven feet per second. The discharge velocity is about four feet per second.

The generator room is shown in Fig. 3. The generators are 31.4 feet in diameter and over 11 feet high. The stators were shipped in four pieces and the rotors in two pieces and assembled in the power house. The two halves of the stator are bolted together and supported at the proper height upon a base, which is supported on steel wedges, which were adjusted exactly as to position and height. It was then clamped down by foundation bolts. The spaces between the base and the floor were filled with concrete and those between the base and the pit liner were filled with type metal. Each generator is supplied with an exciter, which is located on a gallery eight feet above the

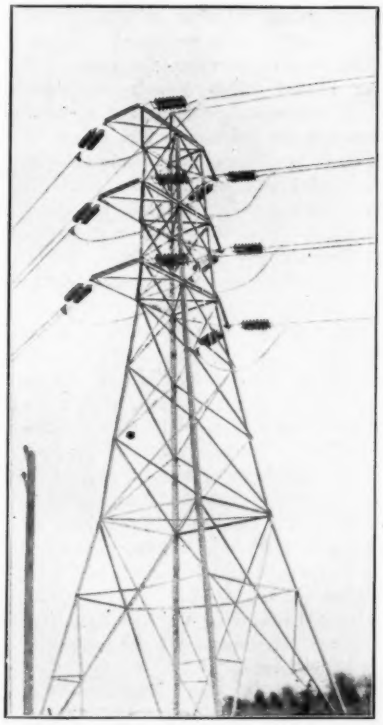


Fig. 8.—Anchor Tower.

main floor, extending the entire length of the generator room. The exciters consist of motor generator sets having a capacity of 110 kilowatts.

The transformers weigh 246,000 pounds each and measure eight by sixteen feet in cross-section and are 24 feet high.

Each transformer has a capacity of 9,000 kilowatts and steps up from 11,000 to 110,000 volts. These transformers are mounted on wheels resting on 100-pound rails, so that they can be rolled out into the gate room under the crane. The high-voltage connections are brought out through insulated bushings built up of alternating rings of porcelain and fibre and filled with insulating compound. They are two feet in diameter and eight feet long and were tested at 450,000 volts. The efficiency of the transformers is 98.2 per cent. Th transformers are water-cooled and each requires 56 gallons of cooling water per minute. One of these transformers is shown in Fig. 5.

The motor-operated oil switches which serve to connect the generators and transformers to the busbars are located on the third floor.

The busbars are located on the second floor, each bar being supported in a separate compartment with a system of concrete barriers, which serve to prevent arcs between different bars. These extend the entire length of the building.

The high-tension busbars are on the fourth floor and are made of two-inch iron pipe hung from the ceiling by disk insulators containing seven units each. The high-tension oil switches are below them. Each consists of three tanks approximately three by six by six feet and weighing 24,000 pounds. (See Fig. 4.) The current passes to the roof through bushings similar to those on the trans-

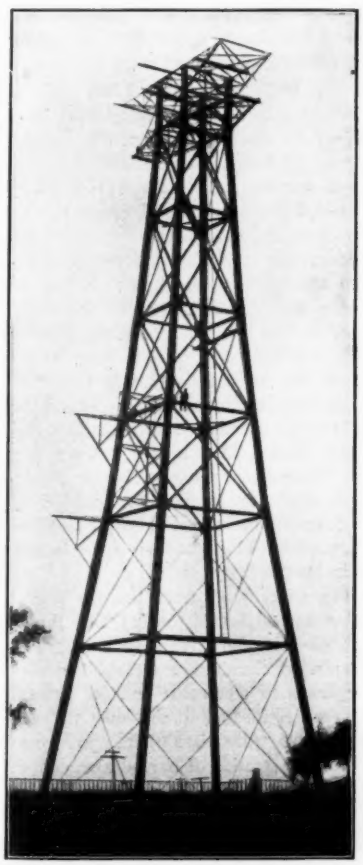


Fig. 9.—Tower at River Crossing.

formers but made of porcelain and compound only. They are designed for 330,000 volts in rain. Choke coils are mounted on the roof, as are also air-break switches, with rotating arms 12 feet long. (See Fig. 2.) The lightning arresters are connected between the choke coils and air switches. Aluminum-cell arresters are used.

The switchboard room is located on the fourth floor at the south end of the building, and is shown in Fig. 6. The electrical connections of the station are here duplicated in miniature on tables of black

slate. Each switch is represented by a button and pilot lights indicate its position. The starting and the speed of the turbines are regulated from this point. There are 25 panels spread over a length of 40 feet, with instruments connected to the circuit of each generator and each of the outgoing transmission lines.

The chief dispatcher is provided with a smaller duplicate of the electrical connections, mounted in a semicircle about his desk, so that the position of any switch in the power house may be seen at a glance. Telephone connection can be had from this desk to any point in the power house or along the transmission line. There are 54 telephone instruments in this system. Storage batteries are used for the operation of telephone lines and for lighting the pilot lamps, when for any reason power from the main generators is cut off from them.

The Transmission Line.

A transmission line 144 miles long has been constructed to connect the power house to St. Louis. It runs on a private right of way 100 feet wide and crosses the Mississippi River twice and the Missouri River once, by long spans of special construction. The special towers used at these points are of the type shown in Fig. 9, whereas the standard type of tower is shown in Fig. 7. The standard towers are 79 feet high and have a base 20 by 20 feet, the weight being 6,800 pounds. The legs are bolted to reinforced-concrete foundations extending six feet below the ground level. The anchor towers are much heavier, each one weighing 10,500 pounds, and have a base 24 by 24 feet, with foundations extending eight feet below ground. The standard span is 800 feet in length.

Seven wires are carried on the transmission towers, consisting of two three-phase circuits and a ground wire. The transmission circuits are arranged in vertical planes 18 feet apart and the ground wires are connected to the apex of each tower. The transmission lines are composed of 19 strands of hard-drawn copper with a cross-section of 300,000 circular mils and a diameter of 0.62 inches. This cable has an ultimate strength of 14,000 pounds and is strung so that the tension will not exceed 7,065 pounds at zero degrees Fahrenheit, in a 60-mile wind, when there is a coating of one-half inch of sleet. The ground wire is a seven-strand galvanized steel cable one-half inch in diameter, with an ultimate strength of 11,600 pounds, and is strung for a tension of 5,500 pounds. The insulators contain seven units, are each three feet long, and are designed for a voltage of 440,000, which is reduced in a driving rain to 330,000 volts. The conductors are dead-ended at all anchor towers, and these are used at all angles in the line and on both sides of railroad crossings.

The river crossings are made in each case by one or more long spans varying from 2,000 to 3,200 feet. The two circuits are separated at the crossings and each, with a ground wire, is run on a separate line of towers, these towers varying in height from 60 to 231 feet, and are designed to support the dead-end strain of all conductors. They are set on massive concrete foundations, which in some cases rest on bedrock and in others on piling. On the river spans, a special cable having a core of high-tension steel is used. This is surrounded with 20 strands of copper, giving an ultimate strength of 52,000 pounds. It is estimated that under the worst conditions the stress will never exceed 24,000 pounds per wire. Special insulators are also used at these points and are made up of six strings of standard insulators interconnected by means of hooks, so that the stress is evenly distributed. A minimum clearance of 60 feet is allowed over all navigable channels, and at other points, 30 feet.

The telephone line is not attached to the steel towers but is strung on one side of the right of way on 30-foot cedar poles. It consists of a pair of No. 8 wires, over which a ground wire is run. At the river crossing the telephone wires are suspended from the ground wire, which serves as a messenger. A cable car running on this ground wire is provided to give connection between the two ends of the crossing. Telephone instruments are located every four miles in booths and also in the patrolmen's houses, which are 18 miles apart.

The dimensions of the line have been so chosen that corona will not appear below 148,000 volts.

The Mississippi River Power Company has a contract with the Union Electric Light & Power Company in St. Louis, Mo., to supply 60,000 horsepower for 99 years. It is estimated that the voltage drop when transmitting this power at unity power-factor will be ten per cent and the energy loss will also be approximately ten per cent. The company is also seeking franchises for supplying power to other towns in its territory. It has, for instance, been granted a franchise for 25 years in St. Charles, Mo., and has a contract to furnish the street lighting for this town for a period of ten years.

The World's Output of Electrical Steel.

In the United States steel by the electric process was first produced in 1908, the output amounting to 55 tons, made by one plant. There is likely to be a considerable increase in production in the near future, although in the first half of 1912 the output is reported by the American Iron and Steel Institute at only 6,882 tons, a surprisingly small total, says *The Iron Age*. "At the present time 14 plants in the United States are equipped with electric furnaces. In addition five plants are now installing electric furnaces or have placed contracts for their installation.

The table which the Comité des Forges de France has compiled is given below. The output of electric steel in Sweden for the three years has been added. Gross tons are used for the United States and metric tons for all foreign countries.

	1909 Tons	1910 Tons	1911 Tons
Germany and Luxemburg	17,773	36,188	60,654
Austria-Hungary	9,048	20,028	22,867
United States	13,762	52,141	29,105
France	6,515	13,445	13,850
Sweden	591	431	2,034
Total	47,689	122,233	128,510

With the exception of the United States, all the countries named in the table show an encouraging growth in the three years. In this country the output in 1911 fell off from that of 1910 by over 44 per cent.

Of the total production of electric steel in the United States in 1911 about 27,227 tons were ingots and about 1,878 tons castings. Almost all such steel made in this country is taken to the electric furnaces in a molten condition from Bessemer converters or open-hearth furnaces. On the Continent, however, and to some extent in Great Britain, cold metal is usually charged in the furnaces and melted by electricity. Of the 29,105 tons of electric steel made in the United States in 1911 over 6,700 tons were alloy-steel. In the same year 462 tons of rails were rolled from electric steel.

Italy has made steel by the electric process regularly since 1903. In 1911 there were four electric furnaces in operation in that country, as compared with two furnaces in 1910 and five furnaces in 1909.

In Sweden in 1911 there were 13 electric furnaces in operation, as compared with 12 in 1910, and 11 in 1909.

Germany first reported the manufacture of electric steel in 1908, in which year the output was 19,536 metric tons. As shown by the table, the production of steel by the electric process in Germany in 1911 amounted to almost one-half of the total output reported for the world. The number of furnaces that made electric steel in Germany in 1911 was 15, as compared with 13 in 1910.

France has also reported the manufacture of electric steel since 1908, in which year the quantity was 2,686 metric tons. For 1911 the number of active electric furnaces is not available, but in 1910 there were 21 furnaces in operation, against 12 in 1909 and seven in 1908.

The Regulation of Public-Utility Corporations by Commissions.

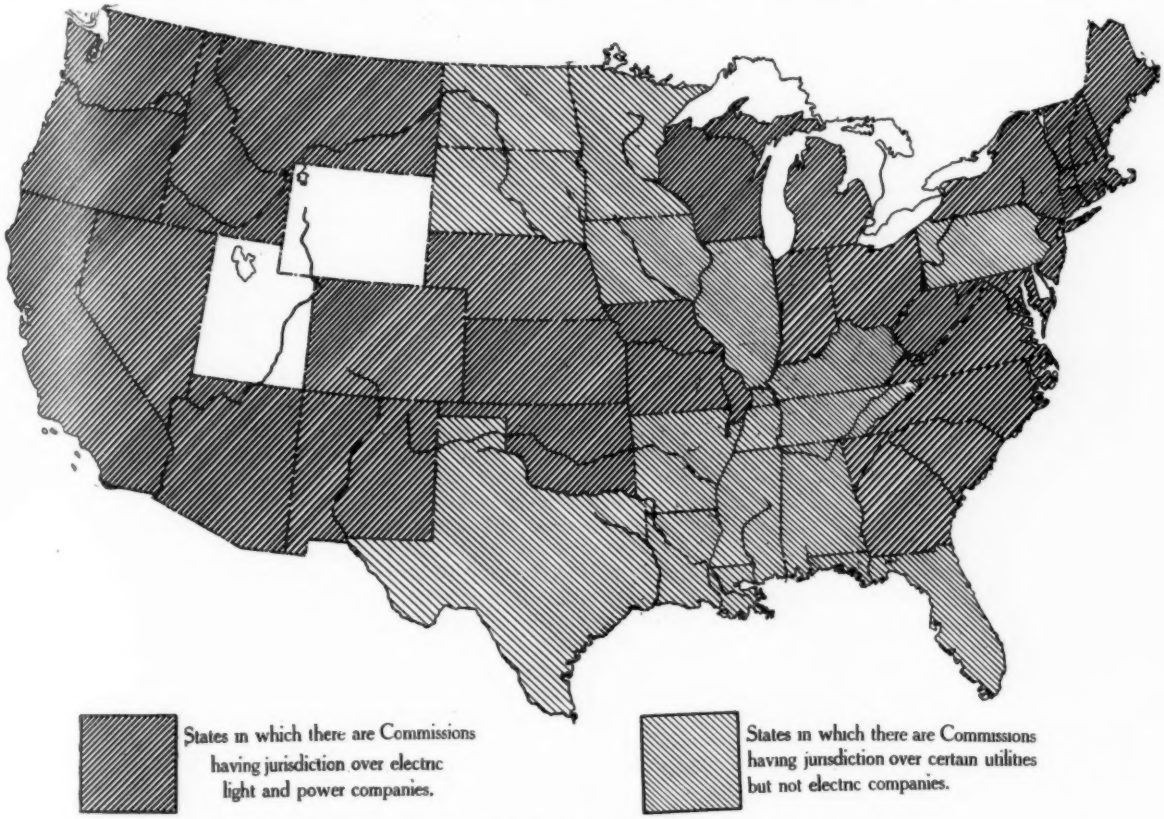
Present Status of Regulation Affecting Electric Companies.

The rendering of those services to a community which are commonly included in the term "public utilities" is by nature a monopoly, since the best service can be rendered with the least expense by having a single system operating a utility of any one kind. It is but natural, then, that the attempts which have been sporadically made to regulate prices and service by the same kind of competition which is common in other lines of business should fail. Where competing utility corporations have been established they have frequently been merged and this seems a natural outcome of such a condition. The solution of the problem of exercising adequate control over public utilities seems to lie between government ownership and regulation by some form of governmental machinery, and the latter at present seems to be the more popular. As between regulation by a state commission and by some local body, the former is gaining in favor, as is evidenced by the recent act of Missouri in abolishing the city utility commissions and placing the entire control in the hands of a state commission.

For a good many years many of the states have had railroad commissions for regulating the rates and service of the railroad companies. Such commissions were naturally the forerunners of the present commissions having jurisdiction over all utilities, since the railroads were among the first utilities to be established and the abuses in connection with their operation have been more prominent than those connected with early water or gas companies. Massachusetts seems to have been the first state to give its regulatory commission jurisdiction over electric light companies, such jurisdiction having been established in 1887. The Massachusetts Board of Gas and Electric Light Commissioners does not, however, have the extensive authority over the rates and management of these companies which now exists in a large number of other states.

In 1904 the Corporation Commission of Virginia was given limited authority over all corporations and in 1907 the Railroad Commission of Georgia was given jurisdiction over utilities in general, but it was the commissions established in the latter year in the states of New York and Wisconsin which may really be regarded as the pioneers in the development of a system of comprehensive control over all public utilities in the state. The acts of these states have been generally regarded as typical examples to be followed by other states in framing legislation on this subject. Nevertheless, many of the states which mave since passed public-utility acts have failed to adopt all of the good provisions in the laws of Wisconsin and New York, and have included in their laws provisions which are admittedly inferior to those enacted by these pioneer states.

In 1908 the Oklahoma Corporation Commission, which had been established by constitutional provision, came into jurisdiction over electric companies, but without control at that time over the issuance of securities. In 1909 Michigan, Nebraska and Ver-


States in which there are Commissions having jurisdiction over electric light and power companies.
States in which there are Commissions having jurisdiction over certain utilities but not electric companies.

Map Showing Extent of Regulation of Public Utilities by State Comissions.

mont, and in 1910, Maryland, enacted laws placing electric light companies under the jurisdiction of regulating commissions. Since that year the trend in this direction has been rapid, and each year sees a group of states added to those in this class. The tendency in these later years has been to give the commission more complete jurisdiction than in some of the earlier cases. In 1911 Connecticut, Kansas, Nevada, New Hampshire, New Jersey, Ohio and Washington were added to the list and in 1912, Arizona, New Mexico, California, Oregon and Rhode Island followed. In New Mexico the commission has no jurisdiction over the rates of electric companies, but in the rest of these states such jurisdiction is given.

The present year has seen a still greater number of states adopt commission regulation or extend to the already existing railroad commissions jurisdiction over electric utilities. This list includes Maine, West Virginia, North Carolina, Indiana, Missouri, Colorado, Montana and Idaho, and Congress has established a similar commission for the District of Columbia. Bills are now pending in the states of Pennsylvania, Delaware, Tennessee, Illinois and Minnesota for the purpose of achieving the same end in those states. The map on page 1121 indicates the states having jurisdiction to at least some extent over electric light and power companies and also the states having railroad commissions without authority over the electric utilities. There are but three states, Delaware, Utah and Wyoming, which have no regulation of any kind.

While the principles which shall govern the decisions of such commissions with respect to the fixing of rates, the issuance of securities, the control of service, etc., are not firmly established, there are already observable certain general trends which forecast to some extent a definite system of principles for the future. Some of the principles involved have come up in court decisions often enough to establish them in a general way, even where the conditions have not been such as to make these principles very specific. No one will deny that a utility corporation is entitled to earn a fair return upon a fair valuation of its property, and any attempt by legislation or commission ruling to establish rates which would not permit of such a return would unquestionably be set aside by the courts as confiscatory. When it comes to fixing a proper valuation and determining a fair rate of return, however, both commissions and precedents are found to be in conflict and each case as it comes up must be decided with respect to its individual merits.

Thus in determining the valuation or appraisal of a property the question may be attacked from the standpoint of original cost, or of outstanding securities or of the cost of reproduction. Different cases often require different methods of attack and in a number of decisions weight has been given to all of these considerations. The general trend of opinion at present seems to be in favor of making the cost of reproduction the basis of appraisal, and this applies especially to cases in which records no longer exist for determining the original cost. Moreover, a number of the statutes governing the subject definitely specify that there shall be allowed a reasonable return upon the property which is at present used and useful in giving service. When the cost of reproduction has been determined, it must be lessened by the amount of depreciation to give the present value, except in those cases where depreciation has been covered by the establishment of a depreciation fund whose amount is sufficient to make up the lessening of value due to this cause.

Many items which enter into the cost of reproduction must be given special consideration. Thus when pipes or conduits have been laid in streets and have since been covered by expensive paving it is not customary to allow as reproduction value the cost which would necessarily be involved at the present time in laying such pipes or conduits, since the latter would involve the expense of tearing up and replacing pavements, which was not incurred at the time the installation was made.

The question of going value is another of the mooted points which must be met upon its own merits in any individual case. While this term means in a general way the expense of establishing the business of a going concern, it is often applied in ways to represent entirely different elements of value. As interpreted by the Wisconsin Railroad Commission, going value represents the cost of developing the business, and is intended to cover actual expenditure in accomplishing this end, or at most, loss of return on the investment while the business was being established. In some quarters going value has been taken to include the capitalized value of a created income, but while such a value may be included in an appraisal for sale, the preponderance of precedent is against its inclusion in a valuation for rate-making purposes.

The value of a created income is also sometimes referred to as a franchise value, and franchise values have been allowed in some notable instances of rate-making, such as that of the Consolidated Gas Company in New York, where it was allowed by the Supreme Court of the United States in reviewing this case on account of state legislation which was regarded as legalizing it. In the Cedar Rapids Gas case, however, the same court refused to include franchise value, and in a number of states it is excluded by law from a valuation for rate-making purposes.

The question of rate of return is another about which there is no definite standard and each case is decided upon its own merits. It appears, however, that five per cent is about a minimum which may be allowed and in some cases the legal rate of interest in the state has been regarded as a minimum. Commissions have allowed various rates of return up to eight per cent in different cases and the courts in general have approved.

The general tendency of commissions is to limit valuation to a minimum and allow a liberal rate of return; whereas, in court decisions the tendency is rather to allow liberal valuations and restrict the rate of return to the legal rate. There seems to be a general disposition on the part of the commissions to have regard for the encouragement of utility enterprises and it is probably for this reason that rates of return are frequently allowed which are higher than those established by court precedents.

Jurisdiction over the issue of securities is not yet as general as jurisdiction over rates and service, but the tendency seems to be to extend jurisdiction in this direction. As to jurisdiction over municipal plants, there is considerable divergence of practice and no likelihood of uniformity being attained. In certain states such as Wisconsin and Maine, jurisdiction is given over municipal plants, whereas in other states, and especially in those like California and Ohio where the sentiment for home rule is strong, the commission has no authority over such utilities.

The following list gives the names of the commission, the commissioners, and the chief clerical officers of those commissions having jurisdiction over electric light and power companies, except in a few cases where there are vacancies. In West Virginia the commissioners are yet to be appointed.

Arizona.

Corporation Commission, Phoenix, Ariz.

W. P. Geary, chairman.
A. W. Cole.
F. A. Jones.

California.

Railroad Commission, San Francisco, Cal.

John M. Eshleman, president.
H. D. Loveland.
Max Thelen.
Alex Gordon.
Edwin O. Edgerton.
Charles R. Detrick, secretary.

Colorado.

Public Utilities Commission, Denver, Colo.
A. P. Anderson, president.
S. S. Kendall.
Daniel H. Staley, secretary.

Connecticut.

Public Utilities Commission, Hartford, Conn.
Richard T. Higgins, chairman.
Theodore B. Ford.
John H. Hale.
Henry E. Billings, secretary.

District of Columbia.

Public Utilities Commission, Washington, D. C.
Chester Harding, chairman.
C. H. Rudolph.
Julian L. Schley.
H. C. Eddy, secretary.

Georgia.

Railroad Commission, Atlanta, Ga.
Charles M. Candler, chairman.
George Hillyer.
Joseph F. Gray.
Paul B. Trammell.
James A. Perry.
Campbell Wallace, secretary.

Idaho.

Public Service Commission, Boise, Idaho.
J. A. Blomquist.
Axel T. Ramstedt.
D. W. Standrod.

Indiana.

Public Service Commission, Indianapolis, Ind.
Thomas Duncan, chairman.
James L. Clark.
Charles J. Murphy.
John F. McClure.
Frank E. Payne.
Joseph L. Reiley, secretary.

Kansas.

Public Utilities Commission, Topeka, Kans.
Henderson S. Martin, chairman.
Myer Hurley.
John M. Kinkel
W. P. Feder, secretary.

Maine.

Public Service Commission, Augusta, Me.
L. B. Deasy, chairman.
W. B. Skelton.
Joseph Williamson, Jr.

Maryland.

Public Service Commission, Baltimore, Md.
Philip D. Laird, chairman.
Joshua W. Hering.
E. Clay Timanus.
Benjamin T. Fendall, secretary.

Massachusetts.

Board of Gas and Electric Light Commissioners, Boston, Mass.
Forrest E. Barker, chairman.
Morris Schaff.
Alonzo R. Weed.
Robert G. Tobey, chief clerk.

Michigan.

Railroad Commission, Lansing, Mich.
Lawton T. Hemans, chairman.
Cassius L. Glasgow.
James Scully.
Willard N. Sweeney, secretary.

Missouri.

Public Utilities Commission, Jefferson City, Mo.
H. B. Shaw.
John M. Atkinson.
John Kennish.
Frank A. Wightman.

Montana.

Public Service Commission, Helena, Mont.
D. Boyle, chairman.
E. A. Morley.
J. H. Hall.
R. F. McLaren, secretary.

Nebraska.

State Railway Commission, Lincoln, Neb.
H. T. Clarke, Jr., chairman.
Thomas L. Hall.
H. G. Taylor.
A. B. Allen, secretary.

Nevada.

Public Service Commission, Carson City, Nev.
H. F. Bartine, chairman.
J. F. Shaughnessy.
W. H. Simmons.
E. H. Walker, secretary.

New Hampshire.

Public Service Commission, Concord, N. H.
Edwin C. Niles, chairman.
Thomas W. D. Worthen.
John E. Benton, clerk.

New Jersey.

Board of Public Utility Commissioners, Trenton, N. J.
Ralph W. E. Donges, president.
Thomas J. Hillery.
W. M. Daniels.
Alfred N. Barber, secretary.

New Mexico.

State Corporation Commission, Santa Fe, N. M.
Hugh W. Williams, chairman.
M. S. Groves.
O. L. Owen.
Edwin F. Coard, clerk.

New York.

Public Service Commission, First District, New York, N. Y.
Edward E. McCall, chairman.
Milo R. Maltbie.
John E. Eustis.
J. Sergeant Cram.
George V. S. Williams.
Travis H. Whitney, secretary.

Public Service Commission, Second District, Albany, N. Y.
— — — — — — — chairman.
Martin S. Decker.
James E. Sague.
Curtis N. Douglas.
Devoe P. Hodson.
F. X. Bisney, acting secretary.

North Carolina.

Corporation Commission, Raleigh, N. C.
Edward L. Travis, chairman.
William T. Lee.
George P. Pell.
A. J. Maxwell, secretary.

Ohio.

Public Service Commission, Columbus, O.
J. C. Sullivan, chairman.
O. H. Hughes.
O. P. Gothlin.
C. A. Radcliffe, secretary.

Oklahoma.

Corporation Commission, Oklahoma City, Okla.
J. E. Love, chairman.
George A. Henshaw.
A. P. Watson.
J. H. Hyde, secretary.

Oregon.

Railroad Commission, Salem, Ore.
Frank J. Miller, chairman.
Clyde B. Aitchison.
Thomas K. Campbell.
H. H. Corey, secretary.

Rhode Island.

Public Utilities Commission, Providence, R. I.
William C. Bliss, chairman.
Samuel E. Hudson.
Robert F. Rodman.

South Carolina.

Railroad Commission, Columbia, S. C.
John G. Richards, Jr., chairman.
G. McD. Hampton.
B. L. Caughman.
J. P. Darby, secretary.

Vermont.

Public Service Commission, St. Albans, Vt.
Charles D. Watson, chairman.
William R. Warner.
George H. Babbitt.
S. S. Watson, clerk.

Virginia.

State Corporation Commission, Richmond, Va.
Robert R. Prentice, chairman.
William F. Rhea.
J. Richard Wingfield.
R. T. Wilson, secretary.

Washington.

The Public Service Commission, Olympia, Wash.
M. M. Godman, chairman.
Arthur A. Lewis.
Harry E. Wilson.
F. M. Larned, secretary.

Wisconsin.

Railroad Commission, Madison, Wis.
John H. Roemer, chairman.
Halford Erickson.
David Harlowe.
Lewis E. Gettle, secretary.

Nela—A University of Industry.

About a dozen years ago 20 of the leading incandescent-lamp manufacturers of the United States organized and established a co-operative engineering department at 4411 Hough Avenue, Cleveland, Ohio, designating their organization officially as the National Electric Lamp Association. The electrical industry is familiar to a great degree with what this organization has done in the preparation of exact data with regard to the science and art of illumination and the practical adaptation of the incandescent lamp as a source of illumination. The engineering department of the National Electric Lamp Association has advanced the art of illumination immeasurably. More than this, however, it has brought into the manufacture of incandescent lamps laboratory and manufacturing standards far in advance of those which were available at the beginning of its career. It has developed a manufacturing organization, and manufacturing and laboratory facilities for its army of employees that place this phase of industry on a par with, if not superior to, similar developments in any other kind of work.

Several years ago it was forecasted that the increasing business of the National Electric Lamp Association, the manufacturing elements of which have now become the National Quality Lamp Division of the General Electric Company, would outgrow the laboratory and engineering facilities on Hough Avenue, and the executive department facilities in the Rockefeller Building in downtown Cleveland. It was the dream of the executive officers of the Association that facilities be provided where the very highest ideal of location and conditions for labor might be harmonized and secured without extravagance and along extremely logical lines. It seemed best, therefore, to the advisory board, consisting of F. S. Terry, B. G. Tremaine, J. B. Crouse, H. A. Tremaine and J. Robert Crouse, to build the necessary new offices and laboratories at a place where land was comparatively cheap and where the absence of dirt, dust and noise would conduce to health and the concentration of thought.

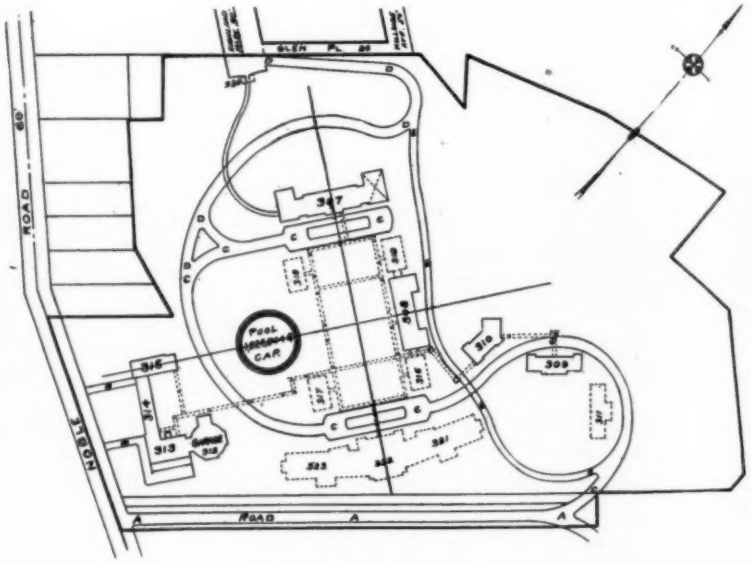
J. R. Massey.

The imagination and ideals of the advisory board have been visualized and made into a stable university of industry through the genius of John R. Massey, chief constructing engineer of the National Quality Lamp Division. Mr. Massey has had all the plans for Nela Park under his general direction, and in his development of this work he has created a worthy successor to the fine line of factories and offices he has equipped for the various works and branches of the Association throughout the country.

Nela Park is a tract of 36.5 acres, located on a plateau 275 feet above Lake Erie. It is situated just east of Noble Road about a quarter of a mile from Euclid Boulevard. The plateau overlooks a ravine through which flows Nine-Mile Creek, and on either side the site is surrounded by a heavy growth of timber and native underbrush. The main site of the park is arranged in the form of a quadrangle. There are at present a Service Building and Garage, an Engineering Building, a Sales Building, Physical Laboratory and Administration Building. There are in course of erection a Working Laboratory and several smaller buildings to house other features of the work.

Ground for the first building at Nela was broken on October 1, 1911. The cornerstone of the Engineering Building was laid March 26, 1912. The cornerstone of the Sales Building was laid July 20, 1912, and that of the Physical Laboratory April 22, 1912. There are 132,747 square feet of floor area in the buildings already erected. The plat printed herewith indicates the location of the various buildings. Beginning at

Entrance of Laboratory.



Plat of Grounds.

Main Dining Room.

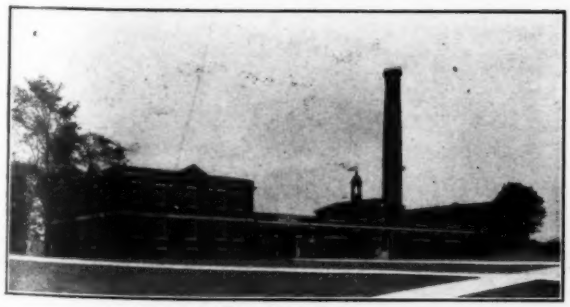
Ladies' Dining Room.

Ladies' Rest Room.

One End of Kitchen.

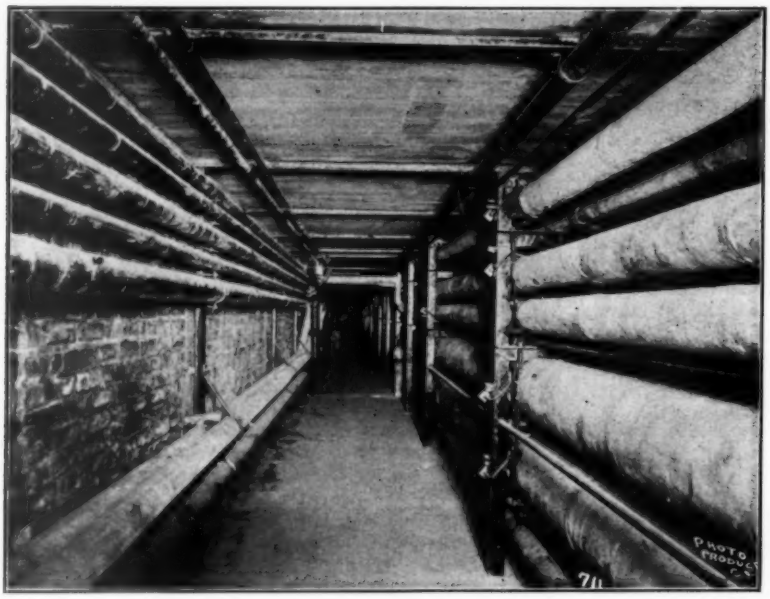
Physical Laboratory.

General View of Grounds.



Power House.

Engineering Laboratory.



Tunnel Connecting Laboratories.

the entrance on Noble Road buildings 314 and 315 are devoted to the service department. Building 313 is the steam heating and emergency power and refrigerating department, and building 312 is the garage with a capacity for storing and taking care of 45 full sized automobiles. Building 307 is the Engineering Building, 308 the Sales Building, 309 the Physical Laboratory and 310 the Administration Building.

Buildings 321, 322 and 323 will be the Working Laboratory.

The grading and landscaping at Nela Park will cost nearly $100,000. The buildings will be connected by level walks, and the roads about the entire site will be boulevarded and parked, and will enable a demonstration of city, suburban, park and boulevard lighting on a large scale.

The architecture of the buildings is of the rather simple English renaissance or Georgian style. This permits of a maximum of window area without detracting from the dignity of the buildings. There are no frills and no extravagance displayed either in the architecture of the buildings, or in their equipment. Everything is on a sane, practical, working basis, and the dominant idea has been to provide adequate and happy working facilities without undue expense. Wallis & Goodwillie, of New York City, were the architects, the construction work being under the direction of Samuel Austin & Son Company, of Cleveland, and the electrical work was handled by the McNerny Electric Company, of Cleveland.

For fire protection there is a circular reservoir with a capacity of 1,250,000 gallons. This reservoir is drained by 12-inch pipes to pressure pumps in the power department, developing a head of 150 feet. The pumps are automatically controlled from any fire plug, and the pressure is maintained by direct-connected motor-driven centrifugal pumps, supplemented by a full equipment of steam turbine-driven pumps. All water for domestic purposes is filtered, passing through settling tanks, and all drinking water is sterilized. There is also an equipment of chemical fire carts and hand extinguishers.

The buildings are of steel and concrete construction, with walls of special Nela brick, a soft-tone tapestry brick of fine appearance and good wearing qualities. The trim is in uniform terra-cotta of a light shade, and the decoration is uniform in character with the name NELA being the only conspicuous ornamentation in the device.

The Working Laboratory will be a three-story building, 120 feet by 496 feet. The central detail is cathedral in design, with plain faced wings flanking the center on inverted angles on each side. Life-test racks will be located on the top of the working laboratory, and the laboratory will have sufficient daily capacity of lamps to work out any new development without throwing any burden or disorganizing the service of any of the buildings of the lamp manufacturers in testing out units of any dimensions or characteristics.

The Sales Building will contain the general sales department, publicity department, general credit department, general service department, which will be in charge of welfare work, the legal department, tabulation department, cafeteria, rest room, kitchen and dispensary. The cafeteria has a capacity which will enable the service of 300 people in approximately six minutes. Without any expense for ornate decoration the equipment of this cafeteria is such that the physical accommodations are superior to those ordinarily found in first-class restaurants and hotels. The best food that the market supplies is served at a nominal cost, and by charging from 15 cents to 30 cents per meal the cafeteria is practically self-supporting outside the appropriation for rent. There is a steward, two chefs and a corps of waiters. The rest room is equipped absolutely

Office in Engineering Department.

in harmony with its purpose, and the dispensary contains a well-stocked medicine and surgical equipment, with five cots for hospital service, in charge of a graduate physician and trained nurse.

The Engineering Building has nine laboratories for photometric work, calibration tests, minor and major testing for laboratory standards, lamp inspection, re-inspection, reflector rooms, converting equipment, storage battery department and offices of the chief engineer. The circuits in the building are so arranged in connection with large panelboards in the corridors that any combination of two-wire or three-wire circuits, either direct-current or alternating-current, and alternating current at any frequency may be available. There is a special reflector room where commercial reflectors and lamps of every type may be measured and demonstrated. In addition to the engineering department and its contributary departments, the Engineering Building also houses the general manufacturing department, treasury, transportation, glass, auditing and power plant.

The Physical Laboratory will house all of the equipment of the physical department for research and development work, and in addition will have an observatory for stellar research.

The Administration Building will house the executive departments.

The inside trim in all the buildings is in natural oak, rubbed down with oil and white lead. The floors are hardwood, well worked in throughout, with several coats of oil to maintain hardness and a high degree of polish. The wall trim is in light buff and neutral tints, and the hardware and fixtures are in semi-polished bronze. The interior lighting is practically uniform throughout with bowl-frosted Mazda lamps on approximately 15-foot centers, placed about 18 feet from the ceiling on rigid stems. Panelux reflectors made of Veluria glass are the predominating glassware; but in many instances special pendent fixtures support semi-indirect bowls. The corridor lighting utilizes the "Realite" unit in practically every instance, presenting a very beautiful daylight appearance and rendering a highly efficient and satisfactory illumination at night.

The buildings are heated from a central heating system which utilizes hot water with a very rapid circulation. Ample radiation is afforded and a record has been established of having a difference of only eight degrees in temperature from main inlet to return on the coldest days. Except in rare instances, the live steam main is not tapped, the entire heating of the circulating water being supplied by the exhaust steam from the turbines driving the forced circulation pumps.

The power plant is equipped with bunkers for a two-months' supply of coal stored under water. The stoking and ash conveying system is automatic throughout, and so complete are the arrangements that one man can run the entire heating system.

The physical conformation of the hill upon which the site is located makes it in the shape of a hard-pan saucer of shale, and the entire plat drains to a common sump, which is cleaned by a float-switch controlled, motor-driven pump ejecting the drainage into the city sewage system.

The steam plant and the various buildings are interconnected by a spacious underground tunnel where on specially constructed racks giving great freedom of access are carried the pipe lines for vacuum, gas, water, air, heat,

Corridor View.

lighting circuits, telephone circuits, watchmen's time detector service measure, annunciator wire service, fire-alarm and the automatic pump control.

There will be eventually about 1,000 persons employed at the Nela Park offices and laboratories. The grounds are easy of access to the employees, and for those who have to make frequent trips to the city of Cleveland proper, or for visitors an hourly automobile service has been arranged. It is estimated that the conditions of labor have been so improved because of the highly satisfactory physical conditions of the buildings and their surroundings that there has been an easing of work of about 30 per cent.

The institution as it stands today would be worthy of more than passing comment if its development had been planned and executed as a Government enterprise. As the work of a private corporation, it stands as a monument to high ideals, and the successful working out of modern business methods which will stand for all times as worthy of emulation.

Sanitary District Power Development.

The waters of Lake Michigan, which are sent flowing down the Drainage Canal by The Sanitary District of Chicago to preserve the health of the people of the District by keeping pure the sources of their water supply, have been made to serve a double purpose. At the point in its journey where the great artificial river intensifies its titanic power by a sheer drop of 36 feet, it is harnessed by turbine water wheels and its dynamic force transmuted into electric power by giant generators, stepped up by transformers into current of high voltage for shipment and transmitted back over the District's line to serve the people of Chicago.

The history of the Drainage Canal is too long and should be too well known to be even touched upon here. The law creating The Sanitary District of Chicago to enable the people to divert the flow of sewage from the lake and keep their drinking water pure, was passed by the Legislature in 1889. The work of digging the canal was begun in 1892 and the Main Channel was completed in 1900, at an expense to that time of about $32,000,000.00. As early as 1897, some agitation was started to make use of the power latent in the enormous flow of water from Lake Michigan at the old controlling works, where there is a drop of twelve feet, but by extending the channel one and three-quarter miles farther south, a fall of 34 to 38 feet and a much more valuable power would be obtained, and enabling legislation for this project was secured from the Legislature in 1903. Work was started in 1904, and in December, 1907, the first current was transmitted to Chicago.

The power house is a long and from the up-stream side, a decidedly rakish building 385 feet long, 70 feet wide and 47 feet high. The retaining walls of the channel are 40 feet high at this point, bringing the water nearly to the top of the building, which is built of concrete on solid rock. The water has a fall of about 34 feet to the turbine water wheels which are located on the floor line in chambers at the receiving side and discharge through conduits under the building into the tail race. At the east of the power house are two bear trap dams to regulate the flow of water. Built at an angle across the channel a few rods above the power house is a concrete guard or fender wall with arches four feet below the surface of the water to let the water through to the power house while the wall slanting towards the dams, diverts floating ice and drift wood from the fore bay. Iron racks extending the length of the house furnish additional protection.

The power house is designed for the installation of eight water-wheel units of 6,000 horsepower and three of 600 horsepower, to operate eight generator units of 4,000 kilowatts each and three exciter units of 350 kilowatts each. The turbine wheels are each mounted on a shaft over 40 feet long and each makes 164 revolutions a minute. These wheels show an efficiency of not less than 82 per cent.

Rated at 4,000 kilovolt-amperes (60 cycles, 6,600 volts), the generators are operated at 163.5 revolutions per minute. They are of very rigid construction, having frames of the box type, strong enough to prevent distortion due to their own weight and magnetic strain. The stator laminations are punched with partly closed slots, permitting the use of solid pole shoes. The windings of the stator are of the threaded conductor type, the conductors being placed in substantial insulating tubes inserted in the slots.

These generators generate electricity of a voltage of 6,600 volts, which is sufficient for distribution near the power house, but for the purpose of sending power to Chicago this power has to be passed through transformers where the voltage is raised to 44,000 volts.

The north half of the power house—a space 385 by 35 feet—is devoted to the generators and exciters, the water-wheel for each machine being located in a chamber adjoining. Traveling over the generator space is a 40-ton electric crane.

The transformer equipment consists of 18 single-phase oil and water-cooled step-up transformers of 1,333 kilowatts each, built with the switchboards, high-tension switches and lightning-arrester equipment. The transformers are arranged in banks of three. Each is guaranteed to operate safely under an overload of 25 per cent. The arrangement of coils is such that damaged ones may be easily replaced.

The main transmission line is 30 miles long. The poles, 60 feet high, are built of steel, of bridge construction, square in cross section, each weighs, complete, 4,000 pounds, and is strong enough to carry the heavy aluminum wires, nearly one inch in diameter, of which there are two three-phase circuits at present and one ground wire carried on the peaks of the poles. The wires are spaced six feet apart.

The poles on a side measure 42 inches at the base and 20 inches at the top. The two cross arms are similarly of bridge construction, the lower arm being 18 feet long and weighing 600 pounds, while the top arm is 12 feet long and weighs 300 pounds. The poles are placed 350 feet apart. They are set into the ground six feet and the hole filled in with concrete which is brought up six inches above the surrounding earth and rounded off at the edges so that no water will lodge about the base.

The poles are designed to carry the transmission wires on the lower arms 47 feet above the ground. The wires are carried 16 inches above the metal arms. The Locke insulators used have a diameter of 14 inches and are 12 inches high.

The 30-mile transmission line terminates in the Terminal Station at Western Avenue. Here also is the store house of the electrical department and the center of the construction corps. This building is built of concrete blocks excavated from the bed of the canal. The substation building is 124 feet long, 70 feet wide and 42 feet high.

In the substation are located transformers to reduce the voltage of electricity to 12,000 volts. Here also are housed nearly 50 oil switches transmitting the electricity to the many distributing lines running through different parts of the city.

Each main line terminates in a set of bus-bars, to which are connected, through oil circuit-breaker switches, two banks of stepdown transformers. These transformers may be operated in parallel by means of an oil switch between the two sets of bus-bars. The secondary current passes through similar oil switches to two sets of low-tension bus-bars and the distributing circuits pass through oil switches to points of distribution. Each circuit is equipped with a power-factor indicator and integrating wattmeter.

The control board in the substation is a duplicate of the panels on the power-station board and the switching arrangements are identical. The elasticity that has been obtained through the switchboard is one of the greatest guarantees of good service, there being no less than six separate and distinct ways of supplying current to each substation.

From the substation, electricity is distributed on transmission lines and conduits to the distributing stations of the city and various other municipalities served by the District, and to other substations from whence it is distributed to the various private consumers.

Oroville Substation Destroyed by Fire.

The short-circuit of a high-tension line leading into the substation of the Pacific Gas & Electric Company at Oroville, Cal., on May 12 resulted in setting fire to the building, which was destroyed. The loss was estimated at $25,000.

Electric-Vehicle and Central-Station Conference in Boston.

A successful conference of central-station men, electric-vehicle manufacturers and agents, and dealers in accessories, was held in Boston, May 20 and 21. Representatives of leading truck and pleasure car firms, together with managers of lighting companies in various parts of New England, were present and participated in the exchange of views on subjects of common interest, with the result that a considerable impetus to electric motor car development in the northeast is expected. The meetings were held under the auspices of the New England Section, Electric Vehicle Association of America, and the Boston Motor Car Club. Sessions were held Tuesday afternoon and evening, and Wednesday morning, at the Engineer's Club, and an average of about 100 were in attendance. President Fred M. Kimball, of the New England Section, presided, except during the opening paper by Mr. Kimball, when E. S. Mansfield, head of the convention committee, occupied the chair.

Mr. Kimball's address dealt with "New England As An Electric Vehicle Field." After reviewing the pioneer work in motor car construction done by the Holtzer-Cabot Electric Company, of Brookline, who built the first practical electric pleasure car, Mr. Kimball referred to some of the difficulties that have been encountered in the New England territory, chief among which was the failure of the electric cab service in Boston in 1905. The period of experiment has passed, however, and the electric is now regarded as a solid proposition. The territory is particularly well suited to the operation of this type of car because of the excellent roads and the frequency of charging stations. The scenery and vacation advantages of New England render it an admirable touring region. The electric truck is also particularly advantageous, in that large quantities of commodities are handled over short distances. Throughout the country about sixteen times as much freight is transported over the highways as is handled by the railroads, and the income to central stations from electric vehicles already reaches the large figure of $800,000 to $900,000 per year. Most of the New England factory towns have excellent garage service. Charging rates are low, with a general tendency toward reduction from time to time. The prospects are bright for the rapid expansion of the pleasure-car and truck industry.

The discussion concerned itself with the durability of the electric and its adaptability to roads with grades. L.

A. Tirrell, of the Commercial Truck Company, considered ten per cent the average yearly renewal cost of an electric vehicle. Col. E. W. M. Bailey, of S R. Bailey & Company, said that some of the earliest horseless wagons built 15 or 20 years ago are still in operation. Harvey Robinson, of the New York Edison Company stated that a vehicle built in 1901 is in use by his company. P. E. Whiting, of the Bailey Company, said that the whole New England territory is readily toured at the present time. On a query by F. D. Stidham, of the New England Auto List, it was brought out that electrics which have a top speed of 26 miles per hour on level ground attain an average speed of 27.5 to 30 miles per hour over a route having considerable grades.

The second paper, written by H. H. Rice, of the Waverley Company, and read by F. S. Rogers, New England representative, discussed the growing popularity of electrics. It was brought out that in October, 1912, there were 33,842 electric pleasure cars in the United States, while new registrations for the years were 5,550, showing an increase of about 20 per cent. About one-half as many electric cars are in use in this country as there are automobiles of all types in France. The increase of vehicles of the battery type is of great interest to central-station men.

During the last six years the mechanical development of the electric has proceeded carefully and soundly. Motor efficiency has been improved, drives perfected, the capacity of batteries greatly increased, and controllers made more dependable. The business is today thoroughly established and safely within its legitimate field. The possibilities of development in motor trucking are well nigh limitless. It was suggested that a man having $4,500 to invest in pleasure cars should buy a $3,000 electric for city and suburban use and a $1,500 gasoline car for long-distance touring. It was stated that today, while gas car manufacturers are running to limited output the electric manufacturers are rushed with orders.

Mr. Mansfield said that the present growth in popularity of electrics is more noticeable in the east than in the west, because the vehicles of this type were pushed earlier in the west, while their active introduction here came more tardily. Trucking interests, he said, are awaking to the advantages of the electric.

Frank J. Stone, of the Electric Storage Battery Company, said that New England is behind other parts of the country in introducing the electric because they are manufactured at a distance. He held that garaging and charging facilities should be improved.

J. H. Hunnewell, of the Lowell Electric Light Corporation, stated that his company has completed a garage to accommodate 20 cars, with equipment to charge any batteries made. He reported an increasing field in his city.

The final paper of the afternoon session was by L. R. Wallis, of the Edison Electric Illuminating Company, of Boston, on "Central-Station Service for the Owners of Electric Cars." He urged that some interested party must provide the information and service required to operate an electric motor car. The interests of the manufacturer and the central stations are closely allied, but in general the division should be on the basis of supervision of that part of the equipment which each supplies. The manufacturer's agent should advise the central station of the details of his sales. The latter can then recommend the best charging apparatus and should assist in installing it in the customer's premises. The central station should fix a charging rate that is fair, in consideration of the nature of the business, and should assist by advertising the advantages of the electric and where practicable maintain a department of vehicle and battery engineering. To meet the customer's needs, the central station should either establish public charging stations or influence others to open electric garages in its territory. All factors should work together in the development of the industry.

F. W. Rollins, of the Worcester Electric Light Company, complained of having had little support from manufacturers in his efforts to promote interest in his city. There are about 75 trucks and pleasure cars in Worcester.

P. E. Whiting, of the Bailey Electric, said he found it difficult to induce gasoline car agents to take on the electric. He held that the central station should not take the agency for any one car, but should boost the business generally.

F. E. Sawyer, of the Salem Electric Lighting Company, stated that his company is pushing the vehicle business. A garage for ten cars is provided, and any agent is assured of cooperation. He complained that agents are attempting to cover all New England, from Boston.

The manufacturers, he said, need more demonstrating cars and more demonstrators.

Frank J. Stone considered it good policy to procure agents among the gas car dealers in the smaller New England cities, while Mr. Whiting thought it better to depend on the Boston agency than risk having an irresponsible agent on the ground.

Colonel Bailey said the central-station management and the selling organization of electric car companies should join hands. Mr. Thayer of the Hartford Electric Light Company said his company is agent for one make of electric truck, but is impartial in its attitude toward pleasure cars.

Mr. Tiffany thought lighting companies should secure agents for carriage concerns. His company had communicated with all the central stations in the country, with slight result.

Eugene Carpenter, of the Martha's Vineyard and Nantucket lighting companies, said the real need is improved service. There should be distinctive signs indicating the location of charging stations and garages. Manufacturers should produce an inexpensive charging set for private use. Central stations should agree on rates for charging. There should be a bureau, under the auspices of the Electric Vehicle Association of America, to send out trained men to demonstrate cars in remote places.

Harvey Robinson, secretary of the Electric Vehicle Association of America, stated that signs to distinguish garages and charging stations are being designed.

Mr. Beals, of the New Bedford Lighting Company, said that his company is selling electricity to one garage for 5 cents per kilowatt-hour and the latter is selling it to customers for 15 cents. The lighting company proposes to sell direct to customers for 3.5 cents per kilowatt-hour during certain times of the day.

Several central-station men agreed to include the advertising of electric vehicles in their company advertising, among them S. Fred Smith, of the Salem Company, and Mr. Rollins, of Worcester. The Narragansett Company, of Providence, is already doing this.

J. C. Bartlett, of Philadelphia, urged that a plan now in vogue with the Public Service Company, of New Jersey, of having men in readiness to advise prospective customers, see to charging facilities and turn customers over to agents, should be adopted in New England. The plan includes the free inspection of cars and reports thereon to the manufacturer.

Albert Weatherby, of the Anderson Electric Car Company, maintained that the district agent must depend on central-station men for service in the smaller centers. The Boston office cannot cover all New England without the lighting companies' active aid.

S. Fred Smith, of Salem, told of his company housing all the cars in that city, in certain instances garaging being rendered free for one year.

Mr. Mansfield stated that the Bos-

ton Edison Company is prepared to give monthly inspection free to all car owners. The New England Section proposes to prepare circulars and provide central stations with this literature for local distribution at about cost.

Mr. Wallis, in closing the discussion, endorsed Mr. Carpenter's suggestion of an inspection bureau under the auspices of the Association. The manufacturers might pay for its maintenance on the basis of their sales, while central stations should contribute unless they furnish the same service themselves.

The evening session opened with a paper by E. R. Davenport of the Narragansett Company, Providence, whose subject was "Construction Criticism." The speaker held that there is too much expense connected with vehicle manufacture, and waste that could be eliminated. He advocated the reduction in price and stated that serviceable pleasure vehicles ought to be produced to sell at $1,250. The price of electrics has been advanced constantly, one make of car which sold in 1904 for $850 now being sold for $2,250. In 1911 the price of this car was $1,750, and in 1912, $2,000. The improvements have been slight. Gasoline cars have been reduced in price meanwhile: adding to a battery cost of $350 to $450 the cost of all the component parts, the speaker urged his claim that a $1,250 car could be built at a profit. Better salesmanship and closer relations between dealers and central station were urged Every salesman should have a demonstrating car and not depend on citing purchasers of cars, he said. Advertising shall contain more definite data and less pretty pictures.

W. C. Anderson, of the Anderson Electric Car Company of Detroit, followed with a discussion on "How a Central Station Can Develop Its Electric Vehicle Load." Mr. Anderson took issue with the preceding speaker on the price of electric automobiles. He praised the Boston Edison Company's activities in developing the electric vehicle industry, by its publicity, the reduction in charging rates and the use of 56 electrics for company business. He complimented Arthur Williams of New York on his important work along the lines of motor-car development, and cited the Hartford Electric Light Company as an example of the ideal manner in which a lighting company has stimulated electric-vehicle progress. Co-operation with the vehicle manufacturer said Mr. Anderson will solve the lighting company's off-peak problem.

The discussion which followed related to both the papers that had been presented. Converse D. Marsh, of New York brought out the fact that certain items in the makeup of the electric cost more than those used in gasoline cars, e. g., the axles used in certain makes of electrics are of special construction and much more expensive. He defended the use of fine catalogs because the electric appeals to women and the artistic may well be employed. Cut price manufacturers have always failed, he said.

Colonel Bailey drew the distinction between cheap and fine cars and claimed that electrics are in the class with the highest grades of gasoline cars. Certain primary costs are higher in their construction than in the building of gasoline cars, and manufacturers are not able to buy standardized parts in large quantities.

Frank J. Stone held that with increased sales prices will naturally fall. He urged that outside central stations expend money in development work on the same scale as the Boston Edison Company.

J. H. Hunnewell, of the Lowell Electric Light Corporation, maintained that the first cost of vehicles and the cost of current are not the major factors in the problem of selling trucks. These are depreciation and maintenance. His company is sponsor for all electrical apparatus introduced in his territory.

William Bee, of the Edison Storage Battery Company, did not believe an serviceable electric pleasure car could be built to sell for $1,250.

J. C. Gray, of Providence, stated that the Narragansett Company sells power in large units as low as eight mills per kilowatt-hour. He held that the electric vehicle yields but a small profit to the central station.

Colonel Bailey urged central-station men to study the situation and provide facilities. He cited instances in which 25 cents per kilowatt-hour is the rate for charging, which he considered excessive.

The paper of Louis Burr on "Proper Selling of Electric Cars" set forth the possibilities of profit to the central station and urged the adoption by the manufacturers of a standard service, with free inspection monthly and free examination of batteries and oiling. The price of charging should be as low as consistent with this class of service. The paper urged better salesmanship, and depreciated the policy of selling cars on commission.

Wednesday Morning Session.

Two papers, and discussion on both occupied the session of Wednesday morning, after resolutions had been adopted opposing the passage by the Massachusetts Legislature of a bill to tax trucks five dollars per ton capacity.

F. Nelson Carle, of New York, presented the first paper, "Advertising the Electric Vehicle, from the Manufacturer's Standpoint." The idea was advanced that manufacturers must at first follow lines of least resistance and sell in given centers and to certain lines of trade. The value of advertising in trade papers, newspapers and magazines was compared. The speaker said trade paper advertising should be directed to the line of trade represented by the publication. Battery men and dealers in other accessories should give advice in matters of local advertising. Manufacturers are inspiring public confidence and the public concedes the superiority of the election in its own field.

The paper by E. J. W. Profitt, of Providence, on "The Electric as an Advertising Proposition, from the Central Station Standpoint," brought out much interesting material.

The rapid development of the business is due, Mr. Profitt said, to a spirit of coöperation among those interested in its promotion. The advertising done by the committee of the Electric Vehicle Association of America, has borne fruit, but the campaign should now be conducted in large part through local newspapers. Central stations and manufacturers should supplement the Association's advertising along lines to be agreed upon. The central station should be prepared for sales of electrics by having facilities for service and the manufacturers could allow the central station $50 to $100 for every vehicle sold, to cover the expense of furnishing service to that car.

The discussion involved the whole subject of advertising. J. C. Bartlett, of Philadelphia, said that advertising must appeal to "ease, pleasure and snobbishness." The idea of economy in pleasure car use has been overworked. Let the agents and salesmen direct their efforts to the rich. Mr. Bartlett advocated a pooling plan of advertising. In 1910-1911 Philadelphia agents spent sixteen per cent of the total car sales in that city in individual advertising, in various newspapers. Then the dealers decided to concentrate on one newspaper. Each of eight agents spent $1,000 for the year's advertising. The objection to central stations doing the advertising is that all newspapers must be used, to conciliate them. The Philadelphia lighting company does not join with manufacturers in advertising, but gives some of its newspapers space occasionally to the vehicle business. The price for charging in that city is 6 cents, and the average income about $8.00 per month per car.

H. W. Hillman, of the General Ve-

hicle Company, recently returned from the South, said he found the principal cities ready to adopt electrics and most large centers already have good garages. The service in Baltimore is of a high type; about 80 trucks are in operation. Mr. Hillman claimed that the income to central stations from current sold for charging is about 30 per cent more than from electricity sold for cooking and heating, because of the high demand in the latter case.

Henry Goodman, of Buffalo, disagreed with the project to allow money to central stations to provide for future service on cars sold.

Day Baker, of the General Vehicle Company, held that the motor cars and trucks give best satisfaction in cities where central stations actively co-operate, as for example in Salem, Lowell, Hartford, Worcester and New Bedford. The adoption of trucks by the express companies in Boston has stimulated the business there.

J. S. Codman, of S. R. Bailey & Company, A. D. Putnam, of Worcester Electric Light Company, and Converse D. Marsh, of New York, participated in further discussion. Mr. Anderson, of Detroit said he was willing to devote funds to central stations for the repair and care of cars where it is impracticable to send a man from headquarters.

The afternoon was devoted to an outing by trolley to Bass Point and Lynn, where a part of the company inspected the motor and turbine departments of the General Electric Company's works. A baseball game was played between representatives of the Boston Edison Company and a nine captained by D. C. Tiffany. The evening was given over to a Shore Dinner and meeting of the Motor Car Club.

Cost System in Electrical Contracting.

At the final spring meeting of the Chicago section of the American Institute of Electrical Engineers and the electrical section of the Western Society of Electrical Engineers, held Monday evening, May 26, this being a joint meeting of the two bodies mentioned, a very interesting paper on "Cost Systems in Electrical Contracting," prepared by Leo Dalkart, of Moline, Ill., was read. The author being unable to attend, the paper he had prepared was presented by J. H. Warder, secretary of the Western Society of Engineers.

The author stated that many electrical contractors have no cost system at all; their practice is that if they lose money on one job they try to realize a compensating gain on some subsequent installation. The reason for the lack of a cost system on the part of some contractors has sometimes been inability to procure one that would fulfill the requirements, because those men who have worked out good systems are frequently very reticent in the matter of letting their competitors know what the details of the system are. The paper then went on to discuss the difficulties in estimating electrical work. It was stated that material costs could be estimated rather closely without great difficulty, but the estimate on labor was liable not to be very accurate. The question of overhead expense and the proper distribution of items of cost was then gone into in some detail, curves being shown which exhibited variations in different items of expense throughout the twelve months of the year. Mr. Dalkart argued that there should be a man-hour overhead element in an estimate on the overhead cost on most jobs the contractor undertakes. The overhead is not the same on a job which consists mostly of labor as on one amounting to the same sum where there is little labor and much material.

The paper was discussed briefly by Ralph H. Rice, chairman of the Chicago Section of the American Institute of Electrical Engineers, John A. Wicum, a Chicago electrical contractor, J. H. Warden, A. S. Pardee, S. Montgomery, and C. D. Wesselhoeft. Mr. Rice said that costs should include the expense of making estimates. He spoke also at some length of the necessity of reliable data as to the depreciation of apparatus and materials.

Mr. Wickum emphasized the importance of proper cost keeping in electrical contracting, and spoke of a system which the National Electrical Contractors' Association has prepared. He said this system made it possible for the contractor to discover at any time just what the condition of his finances were, and what the work on any job undertaken was amounting to.

Mr. Pardee thought that too much time was spent, when estimates are being made, on inconsequential items; it seemed foolish to him, for example, for an estimator to state that a prospective job which he had figured would amount to, say $39,652.33. A statement of this kind is deceptive; it leads one to imagine the estimate is more accurate than it really can be made. Mr. Montgomery discussed the mistake of charging against overhead expense items which could easily be charged up directly to some particular part of a job.

The next joint meeting of the two organizations will be held early in the fall.

RAILWAY ELECTRIFICATION.

Annual Meeting of the American Institute of Electrical Engineers.

The annual meeting of the American Institute of Electrical Engineers was held in New York City on the evening of May 20, and was called to order by President Ralph D. Mershon.

The report of the tellers in the election of officers was then presented and the following were declared elected: president, C. O. Mailloux; vice-presidents, H. H. Barnes, Jr., J. A. Lighthipe and C. E. Scribner; managers, B. A. Behrend, Peter Junkersfeld, H. A. Lardner and Lewis T. Robinson; treasurer, George A. Hamilton.

The annual report of the Board of Directors was also presented but was not read.

The meeting was then turned over to the Railway Committee, whose chairman, Frank J. Sprague, was then called to the chair. The first paper presented was by H. M. Hobart, and was entitled, "2,400-Volt Railway Electrification."

2,400-Volt Railway Electrification.

The requirements of a railway load are of such a character that electricity can in many instances be profitably sold at a price, delivered to the substations, of less than one cent per kilowatt-hour. It is no longer of interest to railways to concern themselves with the large capital outlays associated with the manufacture and transmission of electricity. Their concern is merely with the relatively small outlay which they will incur for substations and for the distribution system; and with the relatively large capital outlay for electric locomotives and for the electric equipment of motor-car trains. The predominating item in the capital outlay is that for rolling stock and against this a credit can equitably be allowed since the replaced steam equipment can be used up on non-electrified divisions. Consequently in investigations undertaken with a view to comparing the cost of electric operation with the cost of steam locomotive methods, the chief items involved relate to operating expenses and to the annual charges associated with the capital outlay for substations, distributing system and rolling stock. It can often be conclusively demonstrated that electric operation is economically superior to steam locomotive operation, even for divisions where the traffic consists of an irregular and sparse service of freight and express passenger trains. 2,400-volt direct-current operation was advocated, with two motors in series and substations 30 miles apart. Estimates of equipment and operating costs were given.

Charles P. Kahler then presented a paper entitled "Trunk-Line Electrification."

Trunk-Line Electrification.

This paper outlines the steam-railroad conditions in the West and gives an idea of some of the results which would occur with electric operation of

the steam railroads. One important point brought out is the characteristic of the electric locomotive to operate overload for short periods and thus be able to haul heavier freight trains over the undulating grades on most steam railroads than is possible with a steam locomotive. The data given showing the distribution of steam-railroad engine service show that it is possible to keep a steam locomotive in service only a small portion of its time, which would not be the case with electric locomotives, which have no fire boxes or boilers to be cleaned out. In the example taken, it is shown that only about half as many locomotives would be required to handle a given traffic by electric operation as by steam operation. A method of analyzing the comparative operating expenses and fixed charges of trunk-line railroads by steam and electric operation is given in a very complete manner. While the financial showing made for electric operation is good, attention is called to the fact that the most important objection to the electrification of steam railroads is the heavy first cost. The purchase of power from power companies and cooperation with them in the matter of building high-tension transmission lines, would considerably reduce the first cost of electrification. A proposed railway was laid out for 15-cycle, single-phase operation, and equipment and operating costs compared with steam. Although the initial expense is large, the saving in operation would pay 10 per cent on the investment.

Mr. Sprague opened the discussion, calling attention to the fact that both authors had found electrification feasible, although different systems were involved. Both eliminated the power station, leaving the question of generation to commercial organizations. He thought the supply at 15 cycles, single-phase, called for by Mr. Kahler, might introduce difficulties.

A. H. Armstrong pointed out that investments made today are not based on the traffic of today, but on the traffic of tomorrow, and the question of cost should be worked out on that basis. Single-phase operation is most attractive where traffic is meager, since the cost for substations and feeder copper are a minimum. On the other hand, operating cost and repairs are greater with single-phase motors. The advantages of both could be combined by transmission with single-phase and the use of mercury-arc rectifiers on the locomotive. Rectifiers have now been built in steel containers with a capacity of 1,000 kilowatts. Another way is to install the rectifier in substations, replacing the rotary converter. The volume of traffic would determine the choice between these. The single-phase commutating motor will soon become a thing of the past. Such a rectifier has been operated upon one of the locomotives for the Butte, Anaconda & Pacific Railroad, built at Schenectady, with satisfaction; 5,000-volt direct-current apparatus has also been built and tested with gratifying results.

F. E. Wynne presented a number of diagrams to emphasize the points brought out in Mr. Kahler's paper. He discussed the paper in detail and also took up a number of points in Mr. Hobart's paper. He thought some railroad engineers would not accept all the figures given in the latter.

E. R. Hill pointed out the interest that railway men generally are taking particularly in electrification, the advantages of which are recognized particularly on heavy mountain grades, where there is a great saving through increase of capacity by increasing the speed, and through reliability of service, and thus the earning power of the property is increased. He mentioned the electrification of the Norfolk & Western Railway between Bluefield and Vivian, W. Va., as an example.

W. S. Murray pointed out the necessity of assuming appropriate conditions for each in carrying out comparisons between electrical and steam operation. The operation of a steam road can often be improved by changing the schedule. The elimination of the firemen through the use of oil-burning locomotives and automatic stokers will enable the steam locomotive to surpass the electric in sustained tractive effort, although the latter has the advantage for sustained power.

Written discussion was submitted by A. H. Babcock, who pointed out that the hypothetical cases considered differed from the actual cases occurring in Pacific Coast practice. He made reports on a great many of the mountain railroads of the West and did not find Mr. Hobart's statements substantiated in these cases. Power companies did not find the railway load attractive, with its large fluctuations, and would not offer a rate which was suitable. Any rate for energy greater than 0.5 cent is prohibitive. The annual load-factor seldom rises above 20 per cent, and loads as large as 45,000 kilowatts may be thrown on and off of a system. From discussion with Eastern engineers he decided that the conditions were entirely different in the two parts of the country.

F. W. Carter submitted written discussion stating that the figures used for electrical operation were rather too favorable; whereas the steam figures were based on actual experience and therefore represented working conditions.

H. Y. Hall and G. W. Welch also submitted written discussion in which the cost figures were analyzed and showed that these would have to be increased to agree with current practice in the West. They conclude, especially in Mr. Hobart's paper, that the estimated costs for overhead construction and substation equipment are very much too low, and hence the electric operating costs are also too low. On the other hand the steam figures are, if anything, too high.

After adjournment a smoker was held in the Institute rooms.

Institute Board Meets.

On the afternoon of May 20 the Board of Directors of the American Institute of Electrical Engineers held a meeting, at which it authorized the holding of an Institute meeting in Philadelphia, Pa., under the auspices of the Philadelphia Section, on Monday, October 13.

Fifty-seven members were transferred to the grade of Fellow, 144 Associates were transferred to the grade of Member, five new applicacants were elected to the grade of Member and 149 to the grade of Associate; 99 students were ordered enrolled.

A. F. Ganz was appointed a member of the Board of Examiners.

The Board approved an amendment to the by-laws of the Edison Medal Committee, which will permit the presentation to be made at any time and place during the year which may be arranged by the officers, instead of at the annual meeting in May. Arrangements are, consequently, being made to present the 1912 medal to William Stanley at the annual convention of the Institute in June.

F. L. Hutchinson was reappointed secretary for another year. Annual reports of all committees were presented and abstracts of these incorporated in the annual report to the Board of Directors, which was approved.

Examination for Electrometallurgist.

The United States Civil Service Commission has announced an open competitive examination for electrometallurgist to fill a vacancy in the Bureau of Mines at a salary of $1,500 to $1,800 per year. The duties of the position are to conduct investigations and inquiries into metallurgical problems, the investigation of ores with reference to treatment and especially the possibility of treatment by electrometallurgical processes.

Ratings will be based upon practical questions in electrometallurgy, general education and scientific training, professional experience and fitness.

As only one application for examination was filed at the previous examination, there is a splendid opportunity now for eligible men to secure immediate appointments through this examination.

Westinghouse Annual Report.

The Board of Directors of the Westinghouse Electric & Manufacturing Company has submitted a report of the operations of the company and of its subsidiary companies for the fiscal year ended March 31, 1913.

The sales billed for the year were in excess of any previous year in the history of the company. The ratio of the manufacturing profit to sales billed increased over last year.

The value of unfilled orders as of March 31, 1912, was $8,137,961; as of March 31, 1913, the value of unfilled orders was $12,061,473. The average number of employees during the year was 20,542, as compared with an average of 16,000 for the previous year.

The surplus as of March 31, 1912, was $6,648,964.29. This balance was increased by the net income for the year and various items detailed in the statement of profit and loss, to a gross surplus of $9,932,203.42. Against this surplus have been charged dividends declared during the year, on the preferred stock at the rate of seven per cent per annum ($279,909) and three dividends of one per cent each, aggregating $1,053,666, on the common stock, also miscellaneous charges totaling $283,187.12. These charges reduced the surplus to $8,315,441.70, against which depreciations of investments aggregating $966,919.56 were written off, leaving the surplus as of March 31, 1913, shown in the balance sheet, $7,348,522.14.

Assets.

Property and Plant, $20,467,244.74—The increase in this item of $1,272,036.68 over the figures as of March 31, 1912, after deducting liberal depreciation charges, represents necessary purchases of additional manufacturing equipment chiefly at the East Pittsburgh and Newark Works and the erection of additional buildings at East Pittsburgh on real estate already owned. No purchases of real estate were made during the year.

A further extension was obtained of the lease of the property on which the company operates an iron foundry at Pittsburgh, Pa. It is possible that the erection of foundry and pattern buildings at Trafford City on real estate already owned will be started during the current year.

Sinking Fund, $160.20—This item represents the uninvested balance of sinking fund payments made to the trustee on account of the company's issue of convertible sinking fund five-per-cent gold bonds. As a result of the sinking fund payment made during the year, there was retired and cancelled a total of $528,000 face value of convertible bonds.

Securities of Westinghouse Electric & Manufactuirng Company—The increase in securities of the company held in the treasury is chiefly due to the receipt from the trustee of $686,000 face value convertible sinking fund gold bonds, in accordance with the provisions of the bond indenture, and to the purchase of $150,000 face value of debenture certificates due July 1, 1913. The bonds are held in the treasury for sale or use for sinking fund purposes, and the debenture certificates will be delivered to the trustee for cancellation on July 1, 1913, on which date the entire outstanding balance of the issue of debenture certificates will mature.

Foreign Companies—During the year the Canadian Westinghouse Company, Limited, made an issue of additional capital stock, to which the company subscribed for its pro rata amount, $243,400, at par, all of which has been paid for excepting $60,850 due under the terms of subscription on May 1, 1913. The Canadian Westinghouse Company, Limited, is paying cash dividends at the rate of nine per cent per annum in addition to adding a considerable sum each year to its surplus.

The increase in the capital stock of the Westinghouse Metalfaden-Gluhlampenfabrik Gesellschaft, m.b.H., represents a stock dividend received during the past year and the item of capital stock of the Compagnie des Lampes à Filament Metallique represents an exchange of the shares of the Westinghouse Metal Filament Lamp Company, Ltd., of London, (a patent holding company) for the shares of the former which is a lamp manufacturing company operating factories near Paris, France, and in Aarau, Switzerland.

The capital stock of the Westinghouse Electric Company, Limited, of London, has been depreciated to the nominal value of $1.00. This is a patent holding company all of the capital stock of which is owned by the company. It also acts as agent and trustee for the company. During the year its expenses have been reduced to nominal expenses for office rent and patent fees.

In general, the affairs of the other foreign companies, with the exception of the Russian Company, show further improvement during the year 1912. The British and French companies particularly give promise of continued improvement. During 1912 the Italian Company received large orders from the Italian Government for electric locomotives and other equipment, on which deliveries will shortly begin. The locomotives are duplicates of those ordered on previous contracts, which have proven successful in operation.

After an exhaustive investigation made upon the ground by the chairman and certain other officers of the company last autumn, the directors determined upon the liquidation of the Russian Company, and have proceeded as rapidly as possible in carrying out the plan. The works, consisting of real estate, buildings, equipment and inventories, have been sold and the collection of its accounts and payments of its debts are proceeding as rapidly as possible. It is anticipated that when its affairs are finally closed up, there will be a further depreciation of approximately $1,500,000, which will mean that the company will receive practically the amount of its current claims against the Russian Company, and that its investment in securities of that company will be entirely charged off.

The increase of holdings in other manufacturing companies is wholly due to the conversion of notes of The Westinghouse Machine Company taken under the plan for the discharge of the receivers of that company in 1908, into six-per-cent bonds of that company. The exchange for bonds was in accordance with a plan in which over 95 per cent of the holders of notes of The Westinghouse Machine Company of the same issue as those held by the company participated.

During the year the company acquired certain bonds and stock of the Lackawanna & Wyoming Valley Rapid Transit Company, in order to permit of the re-organization of that company which is now under way on a basis which the Directors feel will make the new securities an attractive investment.

The Electric Properties Company which owns the entire capital stock of Westinghouse, Church, Kerr & Company, was organized originally as an ally of the Westinghouse interests, but the company was not a stockholder therein, the principal stockholder being The Westinghouse Machine Company, The Westinghouse Electric & Manufacturing Company, together with Messrs. Stone & Webster, of Boston, The Equitable Trust Company, of New York, and Wm. Morris Imbrie & Company of New York, each taking a quarter interest, acquired The Westinghouse Machine Company's holdings, which was the controlling interest.

Current Assets—$18,126,991.53 — The amount of reserve for notes and accounts receivable as of March 31, 1913, is believed to be sufficient to provide for any probable shrinkage of the book value thereof, with the possible exception of a note of the Security Investment Company, to which reference was made in the directors' report for the year ended March 31, 1911.

Advances were made to foreign companies on notes and open accounts as follows: Russian Company, $454,155; French and Italian Companies, $273,032; Austrian Company, $225,508; French Lamp Company, $50,000.

The working and trading assets are

placed at $18,510,222.56. A large increase in these assets over the value as of March 31, 1912, was to be expected in view of the increase in shipments billed during the year as compared with the previous year, and the increase of approximately $4,000,000 in the value of unfilled orders on hand as of March 31, 1913, as compared with the close of the previous year. The usual annual inventories of all raw materials, finished stock and work in progress were taken and valued at purchase prices or manufacturing cost, or less. A fixed basis has been established for the depreciation of inactive stocks. Other assets are placed at $7,011,528.36.

Liabilities.

An outstanding balance of debenture certificates matures July 1, 1913, and is expected to be provided for by the sale of convertible sinking fund bonds of an equal total face value that under the terms of the bond indenture were reserved to retire them.

The four-year notes issued under the plan for the discharge of the receivers of the company, matured January 1, 1913, and were paid.

During December, 1912, and March, 1913, the company borrowed with treasury secureties as collateral, $3,500,000 on notes maturing in June and September, 1913. On August 1, 1913, the issue of $4,000,000 three-year collateral notes made August 1, 1910, will mature, and the directors have under consideration plans to provide for these maturities which it is expected will effect a considerable reduction of the total.

In 1912 there were 3,009 patents issued in Germany for electrical inventions.

Consolidated Statement of Income and Profit and Loss for the Year Ended March 31, 1913.

Gross Earnings:		
Sales billed		$39,977,565.89
Cost of Sales:		
Factory cost, including all expenditures for patterns, dies, new small tools and other betterments and extensions; also inventory adjustments and all selling, administration, general and development expenses		35,406,293.69
Net Manufacturing Profit		$ 4,571,272.20
Other Income:		
Interest and discount	$ 294,887.22	
Dividends and interest on sundry stocks and bonds owned	647,908.46	
Miscellaneous—Royalties, etc	53,768.20	996,563.88
Gross Income from All Sources		$ 5,567,836.08
Deductions from Income:		
Interest on bonds and debentures	$1,103,423.77	
Interest on collateral notes	409,672.34	
Interest on long-term notes and mortgages	99,319.32	
Depreciations charged against income	606,128.73	
Proportion of expenses incidental to bond and note issues	90,000.01	
Miscellaneous	95,259.66	2,403,803.83
Net Income Available for Dividends and Other Purposes		$ 3,164,032.25
Profit and Loss Credits:		
Profit and loss—Surplus, March 31, 1912	$6,648,964.29	
Profit on bonds purchased	1,747.40	
Adjustment of appraised values of property and plant accounts	27,220.51	
Miscellaneous	90,238.97	6,768,171.17
Gross Surplus		$ 9,932,203.42
Profit and Loss Charges:		
Dividends on preferred capital stock	$ 279,909.00	
Dividends on common capital stock	1,053,665.60	
Depreciation of investments	966,919.56	
Miscellaneous	283,187.12	2,583,681.28
Surplus, March 31, 1913, per balance sheet		$ 7,348,522.14

Security Issues in Massachusetts.

Governor Foss of Massachusetts has vetoed a bill recently passed by the Legislature relative to the issue of stock and bonds by electric light and power companies. The governor's objection to the measure is that these companies would be enabled to bond their property to twice the amount of the capital stock, without the safeguard of a mortgage. The present law allows bonds to be issued only to the amount of the capital, except that railroads may issue bonds to the amount of twice their paid-in capital provided these bonds are secured by mortgage.

The governor says: "The policy of the Commonwealth toward its public-service corporations, in view of the fact that they are so largely and essentially monopolies, has been one of conservatism in respect to the issue of their securities, recognizing the importance of such restrictions to the interests of the customers of such companies, as well as of the investors whose money makes possible the existence of such companies and the extension of their facilities.

"One purpose of the existing limitation upon the amount of bonds and preferred stock was undoubtedly to secure for the corporation the benefits resulting from the active interest of those possessing a substantial share in the securities of the company. Bondholders have no voting power; preferred stockholders frequently have none, that power being usually vested in holders of the common stock only, who, however, under this bill may have in all not more than approximately ten per cent interest in the property. A larger interest responsible for the actual management of the property would undoubtedly tend to increased security for all classes of the company's investors. Control by a small interest invites more to stock speculation and corporate manipulation than to economical operation and management."

Co-Operation of Electric Power Companies in Northern Italy.

In a report furnished by an American consular agent at Turin, Italy, it is stated that an important step was taken recently by two hydroelectric companies in the northern part of Italy, with a view to avoiding competition between them in furnishing current to consumers, and also with the aim of making their power stations work in parallel, so that in case of temporary failure of one the current may be furnished by the other Other adhesions are expected to this compact, and probably in a few years' time all northern Italian companies producing electric current will combine for these two purposes It will then be possible to do without subsidiary steam plants. Not all the electric companies have currents of the same voltage, and large transforming plants will have to be built. All the power stations of the Societa Elettricita Alta Italia developing more than 40,000 horsepower are now running in parallel.

International Engineering Congress.

The American Society of Civil Engineers, the American Institute of Mining Engineers, the American Society of Mechanical Engineers, the American Institute of Electrical Engineers and the Society of Naval Architects and Marine Engineers have appointed a permanent committee of management for the International Enginering Congress to be held in San Francisco in 1915. The committee has effected a permanent organization with Prof. W. F. Durand as chairman and W. A. Cattell as secretary-treasurer and has established executive offices in the Foxcroft Building, 68 Post Street, San Francisco.

City of Chicago to Install Meter-Testing Equipment.

The department of Electrical Inspection in Chicago is arranging to install a complete equipment for the testing of watthour meters in the department laboratory in the city hall building. There is a city ordinance which requires the city to test any meter when the test is asked for by the person using it, and the laboratory installation now being made will especially facilitate work of this kind. The installation will also be used to run tests on the city meters.

Among the Supply Men

Spring Meeting of the Electrical Supply Jobbers' Association.

The spring meeting of the Electrical Supply Jobbers' Association was held at the Congress Hotel, Chicago, May 26, 27 and 28. The executive session was held on Monday morning with Mr. Overbagh in the chair, at which routine business was presented. On Monday afternoon the members of the Association were addressed by Ernest Freeman, president of the National Electrical Contractors' Association. On Tuesday morning W. E. Robertson, vice-president and general manager of the Robertson-Cataract Company, Buffalo, made a stirring address which aroused great enthusiasm. Tuesday afternoon was given up to an inspection of various points of interest about the city, the majority of the jobbers and manufacturers present, however, attending the base ball game of the Chicago and St. Louis teams. On Tuesday morning, the ladies were given an automobile ride through the parks and boulevards of the city, with luncheon and cards at the South Shore Country Club. On Wednesday morning there was an open session, at which J. M. Wakeman, general manager of the Society for Electrical Development, Incorporated, made an address in which he outlined the idea of the organization and plans of the Society.

Among those in attendance were H. C. Adams, Pawtucket; E. G. Bernard, Troy; J. B. Baker, New York; W. A. Brown, Chicago; F. M. Bernardin, Kansas City; F. V. Burton, Bridgeport; A. Hall Berry, New York; Walter F. Bissell, Toledo; F. R. Bryant, Chicago; H. A. Brereton, Buffalo; Oscar Carmen, Indianapolis; C. M. Crofoot, Cincinnati; N. C. Cotabish, Cleveland; C. R. Corrigan, Pittsburgh; H. B. Crouse, Syracuse; S. A. Chase, Pittsburgh; W. H. Colman, Chicago; W. P. Crockett, Chicago; W. J. Dougherty, Montreal; B. B. Downs, St. Paul; T. M. Debevoise, New York; B. M. Downs, Covington; W. E. Deming, Schenectady; A. P. Eckert, New York; J. B. Esterbrook, Warren; W. M. Gloeckner, Philadelphia; E. R. Grier, Hartford; A. C. Garrison, St. Louis; H. L. Grant, Chicago; L. Griesser, Cleveland; R. E. Gorton, Warren; C. L. Hight, New York; H. H. Hornsby, New York; N. G. Harvey, Chicago; C. J. Hills, Hartford; C. P. Hill, Pittsburgh; H. B. Kirkland, Pittsburgh; Frank Kuhn, Detroit; P. S. Klees, Hartford; A. W. Lindgren, Duluth; W. W. Low, Chicago; F. D. Masterson, Boston; C. S. McKinstry, Cleveland; Max McGraw, Sioux City; J. H. McGill, Valparaiso; J. R. MacNaughton, Detroit; H. F. MacGuyer, Providence; W. H. McCombs, Pittsburgh; Albert Mann, Boston; M. A. Oberlander, New York; J. P. Provost, Pittsburgh; F. S. Price, Boston; H. T. Paiste, Philadelphia; Franklyn Overbagh, Chicago; C. McKew Parr, Hartford; G. L. Patterson, New York; A. H. Pease, Hartford; F. L. Pardee, Buffalo; C. Russell, Albany; W. E. Robertson, Buffalo; H. C. Rice, Cleveland; C. W. Ridinger, Pittsburgh; T. C. Ringgold, Chicago; Frank Stout, Plainfield; C. C. Sibley, New York; B. H. Scranton, Detroit; W. D. Steele, Chicago; J. H. Trumbull, Hartford; H. L. Walker, Detroit; Bruce Wetmore, Boston; A. B. Wilson, Conneaut; Charles White, Boston; F. D. Witwer, Cleveland.

Front Cover of "Electron."

The next meeting will be held at Niagara Falls, N. Y., the second week in September.

The Monarch Electric and Wire Company of Chicago, Ill., is conducting a general publicity campaign of direct advertising, which is resulting in a large share of business in the company's general line of merchandise.

The Electric Appliance Company of Chicago, Ill., announces that it is vigorously pushing the sale of high-tension line construction material, including lightning protectors. There is also great activity in park and boulevard post lighting and series street lighting. Business is very good in general, with an unusual demand for material used in the construction of high-tension lines taking in small towns from larger centers. The A-W Mazda regulator used for the automatic control of series Mazda street lighting systems is meeting with great popularity, and there are new orders booked for this interesting and important system practically every day in the week.

The *Electron* for May, published by the Central Electric Company, displays one of the most interesting and artistic cover pages that has been seen for a long time. It represents the interior of a compartment car showing the utilization of the Alexalite system of illumination, and the comfort and convenience of an electric fan. It radiates sweetness, cleanness and healthfulness. Among the interesting matter included in the table of contents is an article by T. C. Ringgold, sales manager of the company, relating some of the history of the electrical business and the changes in general conditions which have come about over the lapse of the last 20 years.

The Interstate Electric & Manufacturing Company, Sioux City, Iowa, has amended its articles of incorporation, and has increased its capital stock from $100,000 to $200,000. The officers are M. McGraw, president; W. S. Warfield, Jr., vice-president; E. B. Perrigo, secretary, and W. J. McGraw, treasurer.

I. N. Butterworth, of the Tri-City Electric Supply Company, Davenport, Iowa, reports that Clarence Schlegel will represent the company after June first in the north eastern Iowa territory. Mr. Schlegel has until recently been a city salesman for the Commonwealth Edison Company.

NEW MEDINAH TEMPLE, CHICAGO.

Meeting Place for N. E. L. A. Convention Meets All Requirements.

To anyone who has had occasion to test the acoustic qualities of the new Medinah Temple, it is easy to see why this building has been selected as the meeting place for the forthcoming annual convention of the National Electric Light Association. A speaker, using ordinary conversational tones from the rostrum can be heard distinctly from any seat in the auditorium, despite its large size.

There are many other features of the building that particularly adapt it for a great gathering such as the National convention is expected to be. Its large auditorium seats 5,200 people comfortably and an unobstructed view may be had of the stage from any seat in the house. Check room, lobbies, reception rooms, smoking rooms, etc., have been arranged and equipped to handle large numbers of people without confusion. This was demonstrated recently, on the occasion of the Commonwealth Edison circus when every seat was occupied. No crowding or inconvenience was anywhere apparent.

Exclusive of the curtained section of the stage behind the proscenium arch, the main auditorium measures 120 feet by 214 feet in plan and 76 feet high from the floor to the peak of the central dome. This dome, which is a flat construction, gilded, forms the central ceiling design and measures 50 feet in diameter.

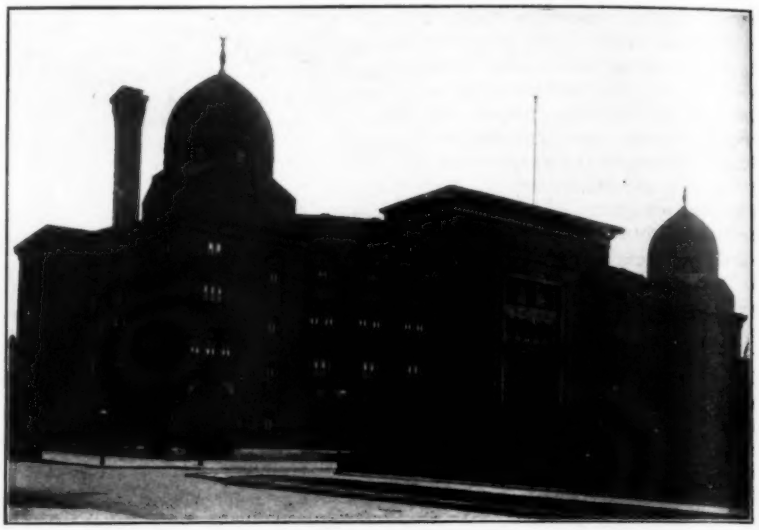
A raised stage measuring 70 feet by 70 feet, occupies a considerable portion of the main floor, as is shown in the interior view, herewith. This stage can accommodate 1,000 chairs, which in addition to the 4,200 permanent chairs brings the seating capacity up to 5,200.

The arrangement of permanent seats is that of a great semi-circle about the stage on three levels, including the main floor and a balcony and gallery. Each level is provided with numerous exits, more even than is required by the Fire Underwriters. Reception rooms, and smoking rooms are located on each level.

The illumination of the building is adequate in every respect and represents the latest practice in auditorium lighting. Tungsten-filament lamps are used throughout. For the general lighting a large direct-current fixture carrying 200 lamps is used, hung from the central dome. Most of the lamps are concealed in reflectors and light the hall by diffused reflection from the ceiling. Smaller units of the same general type are used in other parts of the main auditorium and building.

The basement of the building will be used for the exhibit hall. This room measures approximately 100 feet by 200 feet, leaving a booth area of 10,930 square feet with 68 booths.

The Medinah Temple is located at Cass and Ontario Streets within easy walking distance of the City Hall. It may also be reached conveniently by frequent street cars on the North State Street line.



Medinah Temple.

Interior of Medinah Temple.

The building was erected, recently, for the Nobles of the Mystic Shrine and follows Moorish architecture. Iced water is pumped throughout the building and a very elaborate ventilating system has been installed. The Commonwealth Edison Company supplies all energy. Further details regarding the electrical equipment are given in an article appearing elsewhere in this issue.

Motor-Driven Cableway for Mont Blanc, Switzerland.

A cableway connecting the Hameau des Pelerins at Chamonix, Switzerland, with the Col du Midi is being constructed. It will serve the Pierre Pointue, situated on one of the most frequented routes for reaching Mont Blanc from Chamonix, and will thus facilitate access to the Grands Mulets. The driving plant will be placed in the upper stations of each section, and will consist of an electric motor of 100 horsepower working the driving pulley of the hauling cable by means of gearing. The works are expected to be completed in 1916. The first section from the Pelerins to La Para is now almost ready, but is not expected to be put in service before 1915, when the glacier des Bossons will be reached. The total cost is estimated at $600,000. MM. Ceretti and Tanfani, of Milan, Italy, are responsible for the plans.

Electrical Construction

THE ELECTRICAL WORK IN THE NEW MEDINAH TEMPLE.

Notes on Equipment and Wiring.

The new Medinah Temple, in Chicago, where the approaching annual convention of the National Electric Light Association is to be held, is a building which impresses one as being especially modern and complete both in design and in all its appointments. It is probably not necessary to explain that this is the new home of the Ancient Arabic Order, Nobles of the Mystic Shrine. This new mosque covers a ground plan which is approximately rectangular in form; it has a frontage of 218 feet and a depth of 150 feet, and occupies the east half of the block extending from Ontario Street to Ohio Street. It is of fireproof construction, and covers the entire half block, with the exception of an eight-foot entrance way to the stage from Ontario Street and one of the same width from Ohio Street. The greater part of the building above the basement level is taken up by the auditorium, which has main floor, balcony and gallery, and a seating capacity of about 5,000. The seating arrangement is such that all seats in a given row are at the same distance from the stage, while all parts of the stage are visible from each seat in the auditorium. The stage is roughly, 64 feet deep, and 40 feet or so of it projects into the auditorium, in front of the curtain line. The average width of the stage is somewhat greater than the depth.

The lower section of the gallery is entered through tunnels leading from the ambulatory of the tunnel floor. This floor is located in the rear of the auditorium in the space between the balcony and gallery.

On the opposite page there will be found an exterior front view of the Temple and a view of the interior of the auditorium.

Occupying the greater part of the basement is a banquet hall with a seating capacity of 2,300. A space 32 by 132 feet under the stage is entirely free from columns and will be used for dancing as required. The basement is now being put in order for the exhibits of electrical material and appliances to be made during the convention referred to above.

Electrical Equipment.

The above is written, of course, with a view to giving the reader a suggestion as to what the opportunities for using electric current in the building under consideration are, and of conveying some idea as to the nature of the problems which had to be dealt with in the installation of the electrical equipment and the circuits for supplying it with energy.

With the exception of the spot lights and other arc lamps used for stage effects, the lighting is done throughout with incandescent lamps. In the wiring, circuits and outlets were provided for approximately the equivalent of 5,000 sixteen-candlepower carbon-filament incandescent units.

The motor load includes a 50-horsepower machine connected to a fire pump; two 35-horsepower units which drive fans which are parts of the ventilating system; two 10-horsepower motors for operating air-washer pumps, these pumps also being parts of the ventilating system; one 4-horsepower and one 2-horsepower motor on the heating plant; two 3-horsepower motors connected to bilge pumps for pumping waste water from floors below the sewer line into the sewers; two 2-horsepower units driving air-compressor pumps for keeping up the pressure on the water system; two 5-horsepower motors connected to house pumps; one 10-horsepower motor driving a vacuum cleaner; a 0.75-horsepower unit for the heat-regulating system; and two 20-horsepower machines connect-

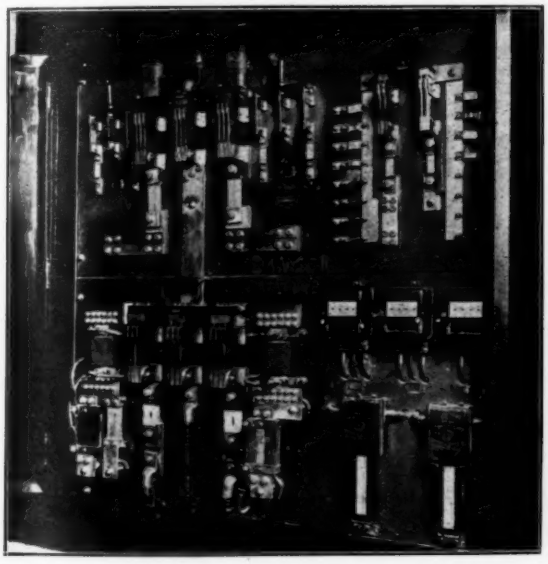


Fig. 1.—Front of Main Service Board.

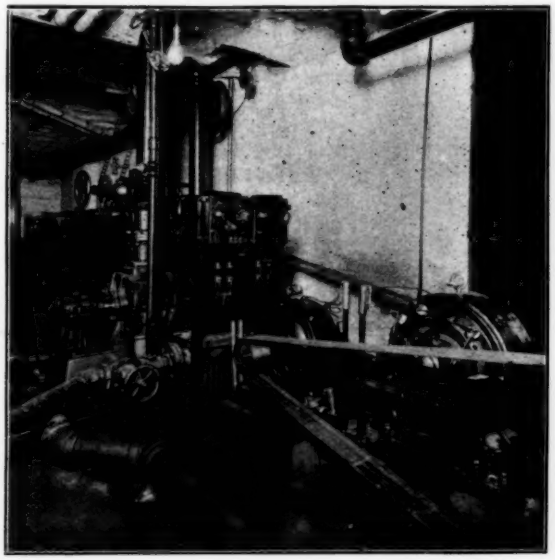


Fig. 2.—Motors on Heating System and Curtain Hoist.

ed to exhaust fans in the attic. A cicuit was also provided for a 5-horsepower motor to drive the air pump for the pipe organ, but this has not been installed yet.

It is especially interesting to note from the above that so many of the motor-driven units are supplied in duplicate. Thus ample capacity and absolute freedom from interruption of service are practically assured. For example, in the case of the bilge pumps, under normal conditions one of the two units installed is able to take care of the service readily enough. There would be no complications, therefore, if repairs had to be made on one of the pumps or upon the motor that drives it. During possible temporarily excessive loads both pumps can be run.

Layout of Circuits.

With the exception of those operating the two exhaust fans, all the motors enumerated above are located in the basement of the building. The 50-horsepower fire pump is provided with its own special service, which consists of two 300,000-circular-mil lead-covered cables run from a manhole near the southwest corner of the building to the switch and cutout panel near the motor. This motor, as are all the others, is a 220-volt direct-current machine. From the manhole just mentioned, which is on the lines of the Commonwealth Edison Company, which company supplies all the current used in the building, three other underground cables are brought in to the main service board, in the basement, shown in Fig. 1. Each outside conductor in this three-wire service has a cross-section of 1,000,000 circular mils, while that of the middle or neutral cable is 500,000 circular mils. The service board contains a main switch for disconnecting the service completely, a switch from which circuits are carried to the various centers of motor control, and three three-pole switches for the control of lighting loads, the capacity of the largest of the three being 1,500 amperes.

Two sets of three 1,000,000-circular-mil cables run from the 1,500-ampere switch to the stage switchboard, which is shown in Fig. 6, and supply current for stage and auditorium illumination, which current is distributed over branch lighting circuits radiating from the stage switchboard and protected by fuses and controlled with switches installed there. From one of the other three lighting switches on the service board three No. 0000 sub-feeders are carried to distributing centers located at points convenient for the control of the lights in the coat rooms, parlors, etc., while the remaining one of the three lighting switches connects a sub-feeder extending to two cutout cabinets in the basement, from which the branch circuits for lighting the basement are run.

An independent service is brought in near the northeast corner of the basement for furnishing the current needed for exit and emergency lights, and these lights are wired on branch circuits run from a cutout cabinet near the front entrance to the Temple. The installation of emergency lights contains lamps enough, both in the basement and in the auditorium, to provide all the illumination that could possibly be needed while an audience was getting out of the building in the event of an accident which had resulted in the disabling of the regular lighting system. In fact, there are so many of these outlets for emergency lighting that one is led to wonder if exercises not requiring special lighting on the stage would usually need to be interrupted seriously by a complete failure of the main lighting service.

It is seen, then, that there are really what amounts to three independent service connections in the Medinah Temple: one for the fire pump; one from the same manhole for regular lighting and the regular motor supply; and one from another manhole at a diagonally opposite corner of the building for exit and emergency lights. It is also seen that the basement lights are wired on branch circuits from two cutout cabinets in the basement, the regular lights on the main floor on circuits from the stage switchboard, the lamps in parlors and the like on circuits from cutout cabinets conveniently located on the main floor and in the balcony, and the emergency and exit lights on circuits from a cabinet near the front entrance to the Temple. It should be added that there are outlets for lamps used in cleaning the house which are also wired from the cabinets installed for the control of the parlor and other similar illumination. The basement lights, the parlor and coat-room lights and the emergency and exit lights are turned on and off with switches in the

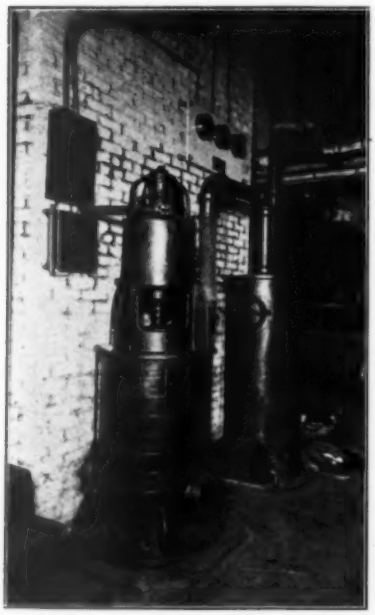


Fig. 3.—Ten-Horsepower Motor Driving Vacuum Cleaner.

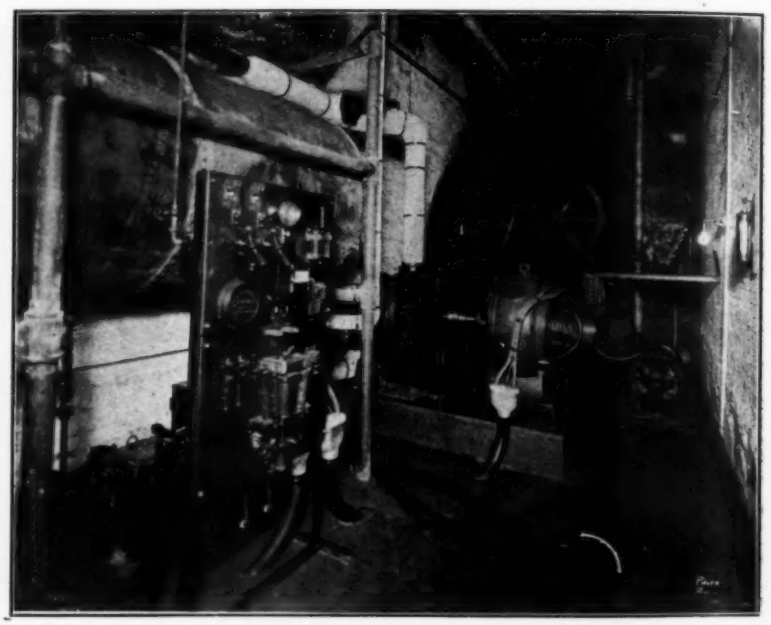


Fig. 4.—Motors Operating Fire Pump and Blower.

respective cutout cabinets, while the switches for the stage and general lighting are on the stage switchboard.

The general lighting in the auditorium includes four large chandeliers, the largest of which hangs in the dome over the center of the main floor and contains the equivalent of 240 sixteen-candlepower carbon lamps. This chandelier is arranged to be lowered and raised by means of a stranded steel-wire cable passing around a system of pulleys to a windlass or winch, the pulleys and winch being in the attic. The wiring to the outlets in the chandelier consists of runs of flexible steel-armored cable extending from special junction boxes.

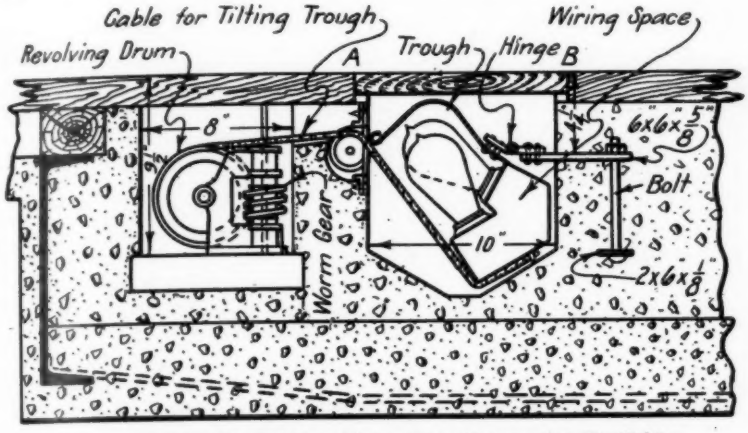


Fig. 5.—Apparatus for Raising and Lowering Disappearing Footlights.

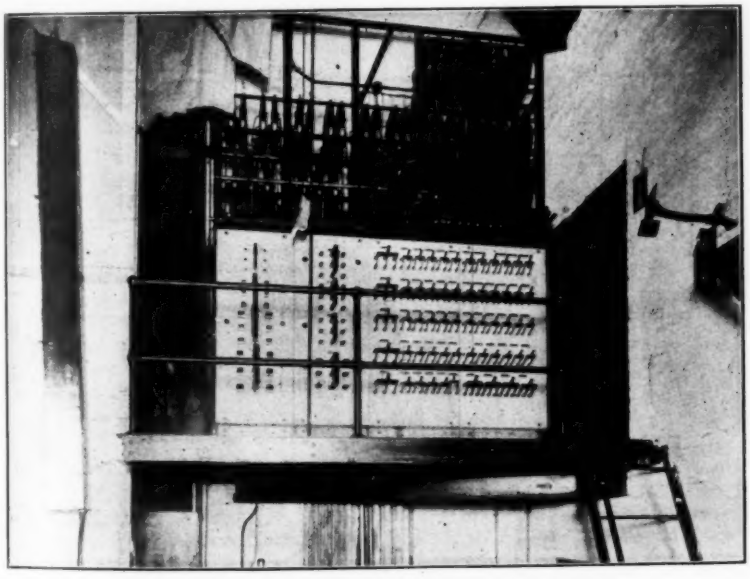


Fig. 6.—Front View of Stage Switchboard and Dimmers.

Further Notes on Stage Lighting.

It is not intended here to go into a detailed account of the sort of lighting units provided for the stage in Medinah Temple; such an account would probably be of but little interest to other readers than those familiar with current practice in theater wiring. There is the full complement of strip lights, border lights and so on. A thing about the illumination on the stage here which is interesting to even the layman in such matters, however, is the arrangement of the foot lights. The footlights around the front border of the stage are kept in place only while they are needed They are arranged in six-foot lengths of portable metal trough, the current to the various sections being obtained by plugging into stage pockets located in the stage floor at convenient points. It was necessary to design a row of disappearing footlights to be run across the stage from one side to the other just in front of the curtain. The design of this was worked out by Mr. Huehl, of the firm of Huehl, Schmid & Holmes, of Chicago, the architects who designed the building and superintended the erection of it. The arrangement adopted is illustrated in Fig. 5, where a cross-section of the trench provided under the stage floor for the footlights is shown. This trench, which extends across the stage, is covered by a removable portion of the floor *AB*. The trough reflector in which the lamps are installed is hinged as shown, and can be raised the proper distance above the floor by winding the flexible steel cable around the revolving drum, which in turn can be easily rotated by means of a worm-gear arrangement provided for the purpose. The reader should understand that, as the figure is drawn, the front of the stage is to his right. The sockets for the footlights are set in an iron box of the form shown in outline in the figure, and the wiring, of course, is concealed within the box.

Other Details of Construction.

It is scarcely necessary to explain that the wiring in the building in question is all in conduits, except where armored cable is used as already noted, and that, for the most part the conduit work is concealed. Pittsburgh Standard conduit and Roebling 1911-Code rubber-covered wire are used. W. H. Brown & Company, of Chicago, was the electrical contractor on the building, and the work was put in under the direction of Gus Gneiss, a member of this firm's staff who is a specialist in electrical work of this kind.

Some of the finest work on the job was done in the installation of the switch and panel boards to which there has been frequent references already. Some of these boards, all of which, as well as the steel cabinets for them and all the border lights and floor boxes, were built by the Electric Apparatus Company, of Chicago, are shown rather clearly in the accompanying cuts. It will be noted, for example, that the main service board is made up of two panels, with the meters and switches mounted on the front. There is one two-wire watthour meter for power and two three-wire watt-hour meters for measuring the energy used in lighting, these instruments being of the Sangamo type. There are also two Wright demand indicators on this board. The knife switches on this and the other boards were furnished by the Barkelew Electric Manufacturing Company, and the snap switches on the various panel boards by the Hart & Hegeman Manufacturing Company.

Test links are provided on the load sides of all meter shunts, and these are held in place with wing nuts so that they can be removed without the use of tools. Two wing nuts are likewise provided, one on either side of the test gap, for connecting

the testing apparatus. Copper-tipped fuses are provided for all switches and cutouts on the service board, and card holders are installed over all switches and meters. The service board is mounted in a metal cabinet braced with angle irons to make it self-supporting. The back of this cabinet is made of removable plates, while in the front there are two doors having spring hinges and vault handles. The circuits enter through holes bored at the proper locations. The service-board slabs are constructed of well oiled slate, two inches in thickness.

The stage switchboard is made of blue Vermont marble, two inches thick and thoroughly polished. There is a baseboard at the bottom which is three inches thick. The edges of all panels are beveled, and copper-headed bolts hold the various panels securely to the supporting frame. As a safeguard against trouble from blowing fuses, the main switches are of the double-throw type, each side being protected by a separate set of fuses but fed from the same set of busbars. Thus if a fuse blows on one side all that is necessary to prevent the circuit which this switch serves from being temporarily crippled is to throw the switch over to the other contracts. These double-throw switches have flush indicating lamps which immediately make the blowing of a fuse known to the attendant at the board.

The space between the back of the board and the wall is inclosed in a fireproof housing, the front portion of which consists of the board itself, the back part of a partition wall, and the top and bottom and end walls of steel plates. Fig. 7 is a cross-sectional view of the switchboard and the housing. On the two-inch fuse slabs behind the board, a section of one of which is shown, and which are made of marble, the fuses for the switches on the front of the board are mounted. Back of these are panels for fuses for the branch circuits leaving the stage board. These, too, are marble panels; they are of the busbar type and are equipped for Edison plug fuses. The thickness of these panels for fuses for circuits is one inch.

In the south end-wall of the stageboard housing there is door 24 by 63 inches, provided with vault handles and spring hinges.

As is clear enough from Fig. 7, the construction is such as to provide properly protected space for bringing in the conductors at the bottom of the board, while a substantial pull box is provided at the top. In the top of this box, at the front of it, there are knockouts through which the circuits are carried to the dimmer installation above the board, this being one of the largest installations of its kind in Chicago. The dimmers which were manufactured by the Curler-Hammer Manufacturing Company, are of the back-connected type and are provided with master arms arranged to secure the best possible control of the lights to be dimmed.

Special Temporary Service.

The Commonwealth Edison Company is now installing special wiring at Medinah Temple for the accommodation of the exhibitors at the National Electric Light Association Convention, to begin there June 2, and for scenic effects around the building. A temporary three-wire service is being brought in to the basement banquet hall, which will supply approximately 500 amperes on each side of the neutral of this 220-volt line. There being only direct-current service on the company's lines in the neighborhood of the Temple, a 50-kilowatt motor-generator set is being installed in the basement for supplying alternating-current power to those who may need it during the convention. There will be eight temporary current-distributing centers in the basement of the Temple to which exhibitors of electrical appliances may connect.

Around the outside of the building the Commonwealth Edison Company is installing 1,000 ten-watt lamps. The company will also erect a doublefaced electric sign which will extend clear across Ohio street and will read "Welcome N. E. L. A." Other temporary lighting the Commonwealth people are installing includes eight 10-ampere General Electric flaming-arc lamps, to be placed around the building, 200 ten-watt lamps in Japanese lanterns inside the tent to be erected on the grounds, and sixteen 250-watt lamps in X-Ray reflectors arranged in two rings around the tent pole.

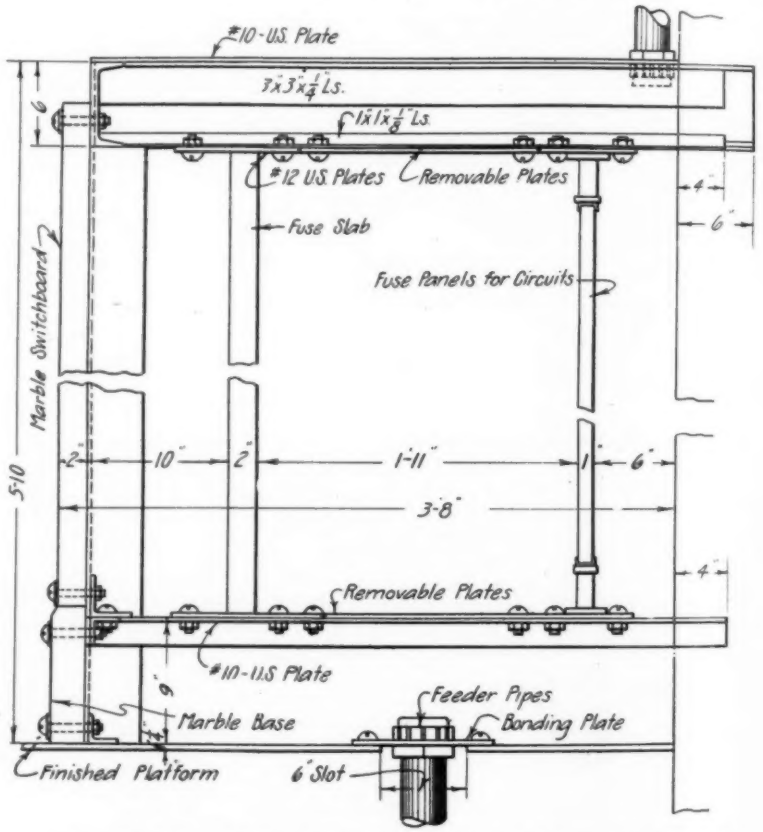


Fig. 7.—Cross-Sectional View of Stage Switchboard and of Space Behind Board.

Among the Contractors.

The Salzer Electric Company, of Cleveland, O., has moved from 805 Superior Avenue to 628 Prospect Avenue, where a finely equipped store of larger size and more central location has been secured. The company is well equipped for handling its expanding trade in supplies, heating appliances, etc., which necessitated its seeking its present larger quarters.

D. P. Greenlee and H. T. Wilson, formerly manager of the Public Service Operating Company, have organized the G.-W. Electric Company at Belvidere, Ill., and will do a general electrical contracting and supply business.

Thirty Years Ago.

Electrical News of 1883 as Presented in the "Electrical Review," the Pioneer Electrical Weekly of the United States—Eleventh Installment.

(From "Electrical Review," New York, May 31, 1883.)

Yelling at a telephone and receiving no reply is "holler" mockery.

The first trial of lighting the electric lamps on the Brooklyn bridge was very satisfactory. Sixty-four electric lamps, each being 2,000 candlepower, form an arch which is of splendid brilliancy.

Brooklyn has taken a step in advance. Signs have appeared on the poles, with a finger pointing to the nearest drug store, or other selected place, with the information that there is a public telephone for pay service within.

The season just past has been marked by the unusual number of scientific congresses and exhibitions which have been held in England and on the Continent. As regards commercial and scientific importance, the electrical exhibition, Paris, 1882, may be safely set down as outranking all the others.

The Bernstein Electric Light Manufacturing Company has acquired the right for the continent of North America to all the inventions made by Alexander Bernstein and all the patents granted to him for the application of electricity to the production of light and the transmission of power. Henry Cram, of Boston, is secretary and treasurer of the company.

The Western Union Telegraph Company will this week begin the work of laying pneumatic tubes under Broadway. It will also lay tubes in which telegraph wires will be carried. There will be six of these tubes, and they will extend from the New Produce Exchange Building to Forty-sixth Street, and through that street to Fourth Avenue. At distances of 400 feet brick manholes about four feet square will be built, so that repairs may be made without tearing up the pavement.

The most important electrical triumph of the age, viz., a means of economically subdividing the electric light, was discovered by an American. His name is Thomas A. Edison. When the news of Edison's discovery reached England, together with a description of how the thing was done, many *soi-disant* scientists there re-discovered the discovery on their own account, while others suddenly awakened to the fact that they, or at least their fathers or uncles or aunts had made the discovery many years ago.

UNDERGROUND WIRES.—Prof. C. H. Haskins, of Milwaukee, says: "The problem of successful underground working has never been solved. Induction, retardation of signals and leakage or bad insulation are the three difficulties that stare us in the face, and these have never been successfully met. In London the wires are all in cables, and these cables are drawn into iron pipes near the curbing. A large force of men is employed constantly in changing and renewing these cables. The ammonia and other gases of the earth speedily destroy the insulation and make renewal necessary. I do not think the underground system the Philadelphia company is putting in can neutralize induction or give good insulation."

Representatives of the Lowell telephone syndicate consisting of W. A. Ingham, Charles J. Glidden, Loran N. Downs, William H. Bent, and A. A. Coburn, came to New York on Friday last to complete the purchase of the Southwestern Telegraph and Telephone Company. The full syndicate is composed of 40 men, who take blocks of $25,000 each, making a total of $1,000,000. The territory is considered the best yet controlled by the syndicate. It embraces the entire states of Arkansas and Texas, and has a total population of nearly 2,000,000, or one-half the size of New England. There are at present 3,000 subscribers. The headquarters will be removed from Little Rock, Ark., to Austin, Tex., the latter place being in the center of the territory. The executive offices of the syndicate will remain at Lowell, under one management. The syndicate now controls nearly one-fifth of the telephones of the United States.

The introduction of electric motors on the tracks of the elevated railroads —a project now under serious consideration—will doubtless prove a priceless boon to those who dwell, or even do business, along the lines of the roads. It is more than probable that the substitution of electricity for steam will also prove successful from an economical standpoint. The dust and smoke and flying cinders from the steam motors now in use have at times proved an almost intolerable nuisance. Pedestrians have had their clothes ruined from flying cinders and oil, and dwelling rooms have been not infrequently filled with dense volumes of smoke from the passing steam motors. *It is safe to predict, too, that at no distant day the street cars, now requiring one or two horses, will be propelled by electricity.* It is the intention, we believe, to carry electricity to the motors on the elevated tracks by means of what might not inappropriately be called an electric main, carried from one end of the line to the other. This system will, perhaps, prove efficient and safe on a private roadbed such as that in question, but we must record our unqualified disapproval of such a system on the surface roads.—[The italics are by the present Editor, thirty years later—to emphasize the words of a good prophet.]

Some Electrical Patents of Thirty Years Ago.

May 8, 1883:

Armature for dynamo-electric machines, Leo Daft, Greenville, N. J.

Automatic telegraph, J. Harris Rogers, Washington, D. C.

Dynamo-electric machine, Joseph A. I. Craig, Montreal, Can.

Electric fire-alarm box, Bernard Frese, Chicago, Ill.

Electric divining rod, Cromwell & Varley, Bexley Heath, County of Kent, England.

Electrical device for winding clocks, George F. Ballou, Waltham, Mass.

Electroplated insulated conductor of electricity, Nathan H. Edgerton, Philadelphia, Pa.

Insulated electrical conductor, Willoughby Smith, Wharf Road, City Road, County of Middlesex, England.

Receiving telephone, Myron L. Baxter, Aurora, Ill.

Splice for telegraph cables, William R. Patterson, Chicago, Ill.

Telephone, Henry Clay, Philadelphia, Pa.

Underground electric conductor or cable, J. Burrows Hyde, New York, N. Y.

(Quotations from ELECTRICAL REVIEW of June 7, 1883, will appear next week.)

New Electrical and Mechanical Appliances

Engineering and Salesmanship in Extending Industrial Illumination.

Nothing has been more apparent to the intelligent observer in the electrical industry during the past two years than the very rapid strides which have been made in the application of the motor drive to industrial work of every description. This has come about very materially through the efforts of the commercial power department of central stations, aided by the very practical information and data which have been supplied by the manufacturers of electric motor equipment. The articles on industrial power applications published in this journal for the last 17 months, have elicited widespread interest and comment, and the question has been raised quite frequently as to the reasons why in a great many installations the interior illumination has not kept pace with the improvements in machinery-operating methods.

This is not at all a general condition, but there has come to view instance after instance where the proprietor of a large industrial plant has been won over to the electric motor drive by the power salesman of the central-station company, and there has not been as conspicuous an advance with regard to the rewiring of his factory or the introduction of the modern systems of lighting units and reflecting electrical glassware. The same condition applies with regard to the opportunity for the electrical contractor, and in many cases where there has been an entire change-over with regard to the methods of driving the machinery of the plant, there has not been a similar advance made with regard to the system of wiring employed, even though this may then be unsuitable.

Tailoring Shop, "The Hub."

Assembling Room, Hudson Motor Car Company.

Machine Shop, Dodge Brothers.

Composing Room, Kenfield-Leach Company.

Industrial Lighting Installations Designed by Bryan-Marsh Electric Works.

At a meeting of the Philadelphia Electric Conference, held in the Meter Department Building of the Philadelphia Electric Company on April 24, Robert B. Ely, illuminating engineer of the Philadelphia Electric Company, pointed out the desirability of the electrical contractor familiarizing himself

with the principles of good illumination, and he estimated that at least $50,000,000 worth of work in the reconstruction of lighting installations was awaiting the live contractor.

The reason for the condition outlined above in the instances enumerated, may be traced very likely to the fact that so apparent has the opportunity been for good work upon the part of the power solicitor that the opportunity for the reconstruction of the wiring system and modernization of the lighting equipment have to a degree been overlooked. That the material for the conversion of the recalcitrant customer has been available is evident from even a cursory study of the volume of literature which has been made available by manufacturers of lighting equipment of every description and the highly trained illuminating engineering staffs which have made their service invaluable to the lighting interests of this country.

There is also ample evidence that where this material and engineering skill have been combined with good salesmanship, the most satisfactory results have been accomplished. One particular instance of the combining of the engineering staff and the selling organization which has produced the most satisfactory returns is the work that the Illumination Department of the Bryan-Marsh Electric Works of General Electric Company has been carrying on from its Chicago office for the last twelve months. Among the many installations planned and equipped by this department the following are worthy of special mention:

The University of Illinois, Champaign and Urbana, Ill., has submitted to the department practically all of its illumination difficulties, and based upon the plans worked out by these engineers the entire illumination for the new stock pavilion and armory has been decided upon. This is one of the most conspicuous examples of engineering and salesmanship, and demonstrates that where the proper methods are applied the most beneficial results are sure to follow.

The National Cash Register Company, Dayton, O., is substituting Mazda lamps for all of its carbon lamp equipment and the entire system of illumination is being equipped with Holophane enameled-steel reflectors.

The Grand Rapids Show Case Company, Grand Rapids, Mich., is changing its illumination from carbon to Mazda lamps, equipped with steel reflectors.

The American Car & Foundry Company, of St. Louis, Mo., is installing single-unit and cluster lighting with Mazda lamps in its foundry.

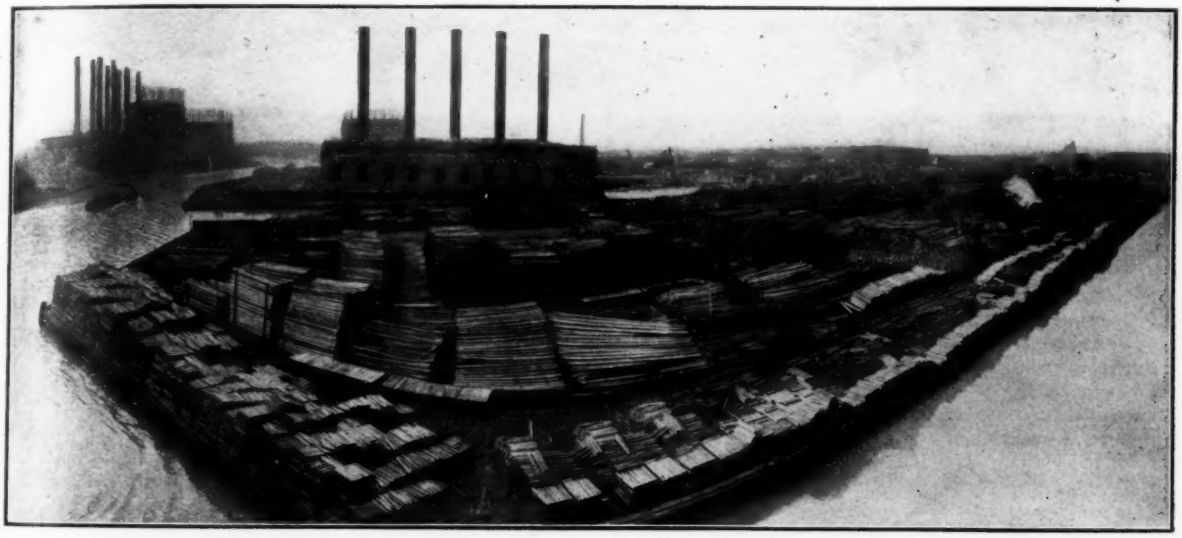
The National Malleable Casting Company, of Chicago, is changing over its entire illumination, which previously was a mixed system of gas, carbon lamps and arcs, to Mazda lamps with Benjamin steel-enameled reflectors.

In the beautiful new "Hub" department store in Chicago, the engineering department of the Bryan-Marsh Works acted as consulting illuminating engineers, conducting illumination tests and laying out the lighting plan, upon the results of which the character of the lighting installation was determined.

Other notable installations that the Bryan-Marsh Electric Works has planned and installed include the Johnson Chair Company, Chicago; Whitman-Barnes Manufacturing Company, Chicago; Pairmont Knitting Company, Chicago; Hudson Motor Car Company, Detroit; The Studebaker Corporation, plants No. 1 and No. 2, Detroit; Reliable Furniture Company, Indianapolis, Ind.; The Herzog Factory, Chicago; Dodge Brothers, Detroit; Richardson Paper Company, Cincinnati; the publishing house of Kenfield-Leach Company, Chicago, and the Milburn Wagon Company, Toledo.

Among the big department stores and public buildings which have been equipped by the engineering department of the Bryan-Marsh Works are the S. H. Kresge Company, Detroit; Ely & Walker Drygoods Company, St. Louis; the Bon Marche, Seattle, Wash.; American Savings Bank & Trust Building, Seattle, and the Otis Building, Chicago.

During the last year the engineering department has handled several hundred installations, co-operating with central stations, electrical jobbers and contractors, rendering expert advice without cost to the recipients, and so popular has the service become that hardly a day passes without some central station or dealer sending a representative to the engineering department for information and instruction with regard to the lighting details of some installation under construction.



Chicago Yard of Naugle Pole Company, Near Fisk Street and Quarry Street Stations.

A Great Pole Yard.

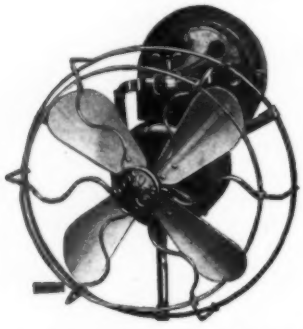
The accompanying illustration gives a good idea of the enormous stock carried at the Chicago yards of the Naugle Pole & Tie Company to supply the demand for poles and ties from this distributing point. These yards are conveniently located for shipment both by rail and water. Special arrangements have been made to facilitate an inspection of these yards during the convention of the National Electric Light Association and those wishing to visit this interesting and instructive exhibit will be welcomed at the company's office, Suite 1802, 5 South Wabash Avenue, Chicago.

General Electric Company's Fan Motors.

The General Electric Company's fans for 1913 comprise both desk and oscillating types in 8, 12 and 16-inch sizes, for both direct-current and alternating-current circuits, the latter for all commercial frequencies, except frequencies above 60 cycles in the 8-inch fan.

This line of fans has self-alining ball-seated bearings with ample wick lubrication and definite oil deflectors and passages to ensure the return of the grease from the shaft to the grease cup.

Those of the alternating type are driven by induction motors, and so have no moving contacts or brushes. Good starting torque is insured by providing them with a reactance type of winding. This is accomplished by providing a two-circuit field, one circuit having an extra resistance and the other an external reactance. This is a great advantage, as the motors can be controlled to a very low speed and yet the resistance and reactance are sufficient to give first-class starting characteristics without any centrifugal switch or change in connections between starting and running conditions.



Telephone-Booth Fan, Bracket Type.

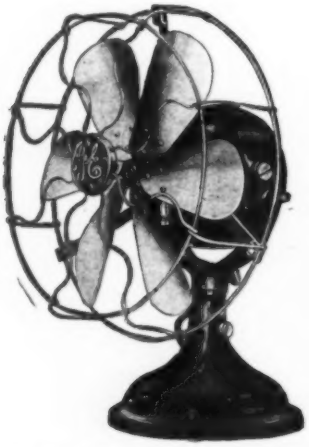
The oscillating fans have a position oscillating mechanism with worm and gear speed reduction. The 12 and 16-inch fans can be adjusted for two angles of oscillating and they are provided with a simple gear change device which can be adjusted for the oscillating position, a locked position or a free position of the fan body. The oscillation of the 8-inch motor can be varied in width from zero to the maximum.

The telephone-booth type of fan is spring-suspended from a bracket, thus making it noiseless and eliminating vibrations which would interfere with the operation of the telephone if they existed. The bracket arm from which the fan is suspended by springs is connected to its base by a hinged joint permitting the fan to be inclined several degrees from the horizontal.

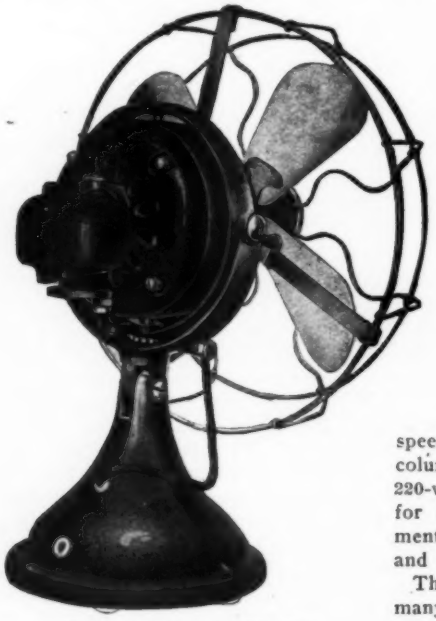
For service in hospitals, residences and places where quiet operation is necessary, the 12-inch 6-blade fan is very satisfactory. The yoke supporting it is hinged to the base and a means is provided for locking it, thus making it a very simple matter to adjust it for either desk or bracket use. The four-point regulating switch permits three running speeds, thus providing regulation for all purposes.

Combination 52-Inch Ceiling Fan and Lamp.

The ceiling fans can be furnished in plain or ornamental designs, and provided with electrolier fixtures if desired, as all ceiling fans are wired for lamps. Alternating-current ceiling and column fans are designed for operation on 25, 40, 50 and 60-cycle circuits. The plain types have two speeds while the ornamental fans have three running speeds. The direct-current ceiling and column fans are designed for 110 and 220-volt circuits, the plain type designed for one speed only while the ornamental types are designed for single and three speeds.



Six-Blade 12-Inch Residence Fan.



Sixteen-Inch Oscillating Fan.

Eight-Inch Oscillating Fan.

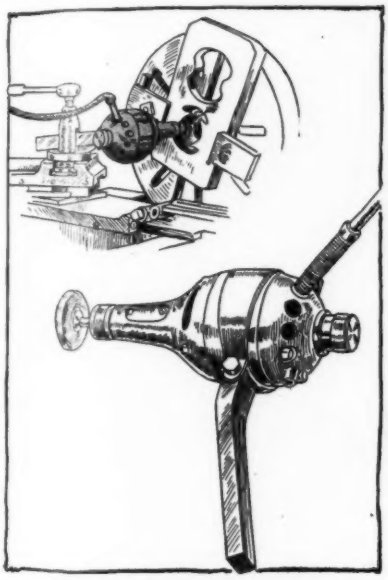
These ceiling and column fans have many excellent features. The armature in each type, with the exception of

the two-pole direct-current fan, rotates upon a stationary spindle of special steel, insuring long life, while the weight of the fan is borne by a ball bearing running in oil, thus minimizing friction and increasing efficiency.

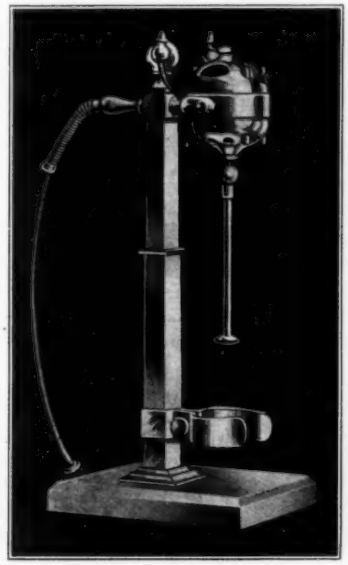
That the excellent qualities of these fans are appreciated is evidenced by the large sales, over 100,000 being sold during the year 1912.

The Hamilton-Beach Current-Consuming Devices.

The Hamilton-Beach Manufacturing Company, of Racine, Wis., is the manufacturer of a very complete line of current-consuming devices suitable for exploitation by the central station, electrical jobber and dealer, and contractor. These devices have been developed to meet a widespread demand for small, compact and rugged equipment using a small amount of energy and presenting a handsome appearance, which adds to their value as an advertising medium. The devices made by the Hamilton-Beach Manufacturing Company are especially for use in connection with a fastidious trade, and their appearance has been studied very carefully as well as has their operating efficiency.



Hamilton-Beach Portable Grinder.



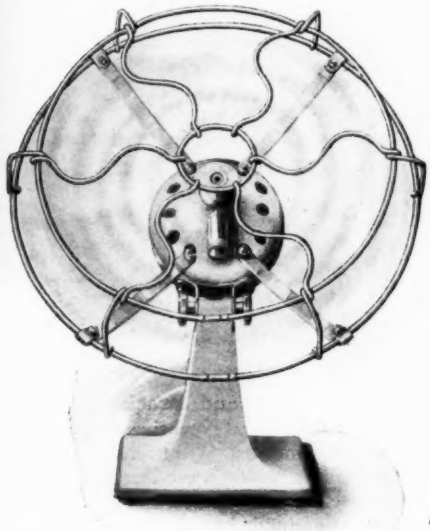
Cyclone Mixer.

Utility Motor.

Hair Drier.

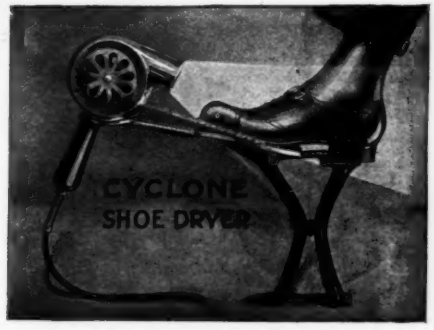
Vibrator.

The Hamilton-Beach portable electric grinder is especially adapted for machine shops and tool rooms. This grinder is equipped with dust-proof bearing caps, eliminating the possibility of grit or dirt coming in contact with the nickel-babbitt bearings. The complete grinder weighs 5.5 pounds. The armature shaft is ground on centers to a mirror finish, assuring extreme accuracy. The motor is air-cooled and proof against excessive heat from overload. A special adjustable end-thrust and bearing take up all wear and play. The grinder may be applied to interior or exterior jobs, and may be used on lathes, shapers or milling machines.



Desk or Counter Fan.

The Hamilton-Beach hair drier is substantially built, the motor casing being made of an aluminum casting highly polished. The motor drives a specially designed fan at 7,000 revolutions per minute, and it is claimed that the operation is absolutely noiseless.



Drying Device.

The heating unit with which the hair drier is equipped is built up of pure mica and hard fiber. The special resistance wire is specially wound so that a maximum radiating surface is secured, giving a volume of hot air instantaneously.

The Hamilton-Beach Cyclone mixer is one of the most popular bar and soda-counter fixtures that has been placed on the market in a long time. It is now in service in first-class hotels in every city in the country. The mixer is made in two finishes, silver plated, mounted on a Mexican onyx base, and nickel plated, mounted on a handsome white Italian marble plate. There are over 25,000 of these mixers now in use.

The Hamilton-Beach vibrator is made in three styles. Types A and C are operated on any electric lighting circuit by simply attaching to a lamp socket. Type B is operated with dry batteries. There are six applicators, for use on various parts of the body, included with each vibrator.

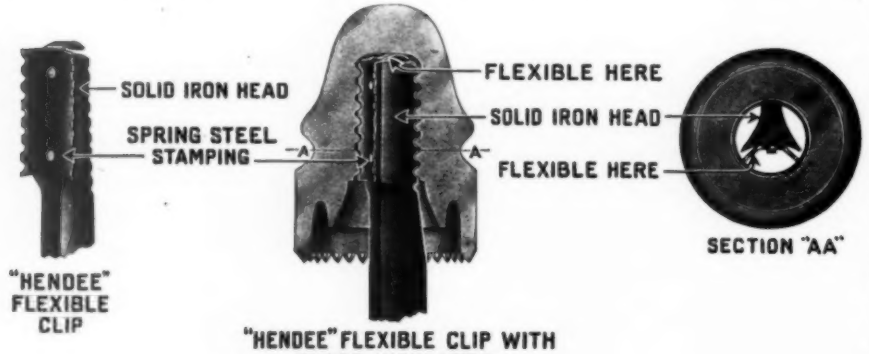
Other devices included in the Hamilton-Beach line are a handsome desk and bracket fan, utility motor and Cyclone shoe drier.

New Hendee Flexible Clip for Insulator Pins and Brackets.

Line troubles are expensive and, as far as the consumer is concerned, are just as bad as power-house shutdowns. To reduce line troubles to a minimum, the selection and installation of the brackets, insulators, etc., is a factor. One of the troubles frequently encountered is caused by the breaking of insulators, due to the expansion of insulator pins and brackets. Solid heads cause breakage in warm weather, while in cold weather they contract and allow the insulator to wobble. Wooden pins give fair satisfaction, but they do not last.

The Line Material Company, of South Milwaukee, Wis., is furnishing all styles of Kyle Line brackets with the patented Hendee flexible clip. This not only provides protection against expansion, contraction and irregularities in the insulator grooves, but has the distinct feature of having a full section of the malleable-iron bracket enter the insulator, and a part section of this is used as a thread for the insulator. The Hendee clip adjusts itself, both in diameter and length, as it not only expands and contracts with the insulator, but creeps up into the insulator.

The malleable iron used in making these brackets is claimed to outlast steel, and this with the ability for absorbing sudden strains or jerks.



Hendee Flexible Clip.

The Oshkosh Guy Anchor.

The Oshkosh Manufacturing Company, of Oshkosh, Wis., has been specializing in the manufacture of construction tools for telephone, telegraph, electric lighting and railroad construction work for many years and has earned an enviable reputation for this material. Its lines include the well-known Roberts patent climber, the Oshkosh folding take-up reel, and a long list of tools for regular and special work of every description undertaken in construction of this character.

It has now added to its line the Oshkosh anchor, for which it makes some very strong claims. It guarantees the anchor to withstand a greater strain than any other of its size, to hold in any soils, to be unaffected by rocky soil conditions and to have a maximum area of expansion. The accompanying illustrations show the anchor closed and expanded, in other words, just as before and after installation.

The anchor is thoroughly automatic, requiring only one man to set it, and the principle of expansion depends upon the strain upon the guy wire. It is claimed that, if for any reason it is left in a partially expanded position, when a greater or emergency strain is placed upon the anchor, it will continue to expand until it takes up the maximum resistance of the soil. The convex top surface of the blades increases the holding power, the resisting force being always normal to the surface of the blades.

Oshkosh Anchor Closed.

Oshkosh Anchor Expanded.

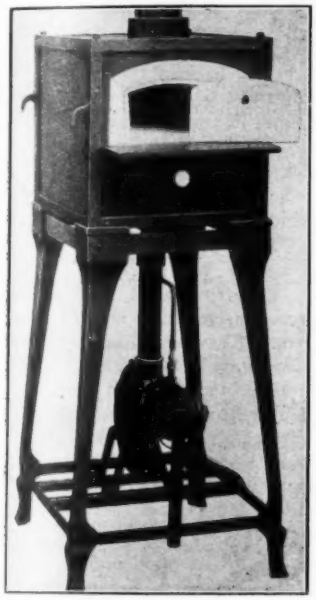
Federal Sign System (Electric) Entertains Central-Station Men and Jobbers.

The Federal Sign System (Electric) entertained between 400 and 500 central-station men connected with the Commonwealth Edison Company, the Cosmopolitan Electric Company, and other central-station interests in Illinois, together with a number of electrical jobbers and dealers, at its factory at Lake and Desplaines Streets, Chicago, on Saturday, May 24. Following a luncheon, the visitors made an inspection of the recently enlarged factory under the escort of the picked men of the company. A great deal of interest was manifested in the various operations in the preparation of the unit electric signs and other specialties manufactured by this company, particular interest being taken in the miniature lamp department where the small individual sign lamps, which have recently become so popular, are made. The magnitude and excellent arrangement of the factory were impressive.

Motor-Driven Blowers for Increasing the Efficiency of Gas Furnaces.

An improvement has recently been made in gas furnaces by forcing the air into the gas by means of a motor-driven blower instead of merely allowing the air to flow in through valves as with the familiar Bunsen burner and gas stove.

This forced draft permits a much higher heat, thereby increasing the efficiency of the furnace, extending the range of work it can handle, and making its production more rapid. It is claimed, for example, that a temperature of 2,500 degrees Fahrenheit can be obtained with an air-blast furnace whereas 1,800 degrees is about the maximum for a similar furnace without the blast.



Gas Furnace with Motor-Driven Blower.

This principle has been applied to furnaces for many lines of industry, such as candy furnaces, rivet heaters, muffle furnaces, etc. The one illustrated herewith is manufactured by the Improved Appliance Company, Brooklyn, N. Y., a Westinghouse motor being used for driving the blower.

New Pass & Seymour Receptacles.

In keeping with its general policy of providing special wiring devices to meet every demand and, in fact, frequently anticipating future demands, Pass & Seymour, Incorporated, Solvay, N. Y., has placed on the market a number of new receptacles and a new socket. Fig 1 is a porcelain cleat receptacle with shade-holder groove to take any standard shade-holder designed for porcelain sockets; it is designated as No. 4013. In Fig. 2 is shown receptacle No. 9402, which is identical with the foregoing with the exception that it has no shade-holder groove. Fig. 3 shows a new receptacle (No. 451) which may be used either on concealed work or on many of the Crouse-Hinds Condulets. A distinctive socket is shown in Fig. 4. It is known as electrolier socket No. 438 with Flutolier shell. It is a reduced size of the standard pull socket and is intended for use with lighting fixtures only. Since

Fig. 1.—Receptacle With Shade-Holder Groove.

Fig. 2.—Receptacle Without Groove.

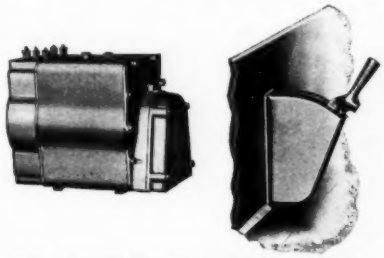
Fig. 3.—New Type Receptacle.

Fig. 4.—Electrolier Socket.

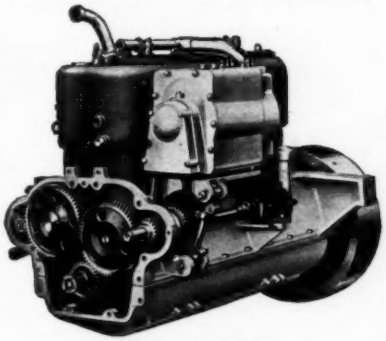
these sockets are considerably smaller than the standard sockets, they permit a more artistic effect being produced.

Adams-Bagnall Electrical Accessories for Motor Cars.

The Adams-Bagnall Electric Company, of Cleveland, O., claims the distinction



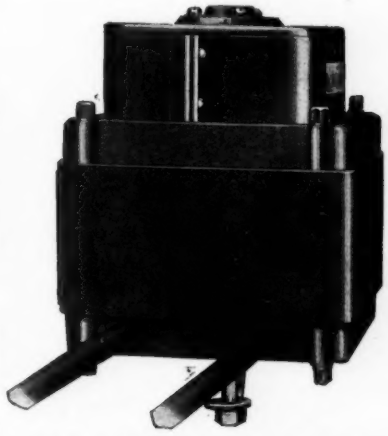
A-B Entz Motor-Generator and Switch.



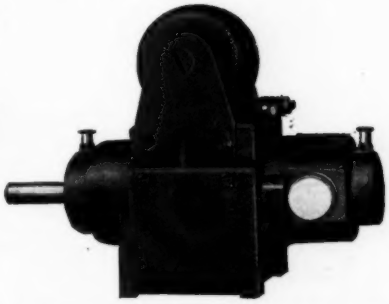
Connection to Engine.

of manufacturing a more complete line of electrical accessories for motor cars than any company in the country. These A-B electrical accessories are: A-B Entz single-unit starting and lighting system; A-B double-unit system—motor for starting and generator for lighting are separate units; Abautolites—electric head, side, dash, tail and trouble lamps, also motorcycle lamps; A-B trumpet; A-B switches for control of lighting and starting systems.

The A-B Entz single-unit system consists of a motor-generator, a switch, a nine-cell battery and such wires as are necessary to connect the switch to the battery. In this system both functions of starting and lighting are performed by one unit, a motor-generator. This unit operates either as a generator to produce current for charging the storage battery, or as a motor (driven by current from the storage battery) for starting the car. It is an extremely simple system, the armature of the motor-generator being the only moving part. It operates either as a motor or generator without automatic switches, controllers or auxiliary devices and without any change in gear reduction.



Starting Motor for Double-Unit System.



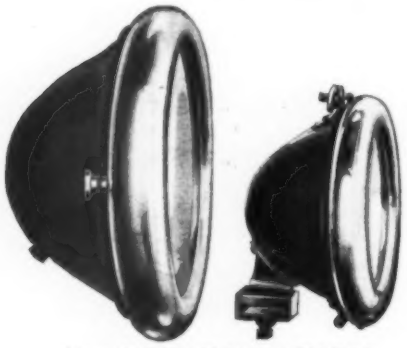
Lighting Generator for Double-Unit System.

The motor-generator is in direct and permanent connection with the engine, being geared to it by means of a silent chain, by direct gearing, or any other means that might be adopted. As soon as the switch is on, the machine operates as a motor and turns the engine over. When the engine starts running under its own power it turns the motor-generator, which then becomes a dynamo

to again recharge the storage battery.

The high power of the A-B Entz system assures positive starting on the coldest day. The engine is turned over from 100 to 150 times per minute. The motor will also propel the car for a considerable distance.

The strength of the system, coupled with the characteristic of charging the battery at low speed, allows the use of higher candlepower lamps having larger and longer filaments. In this way the long projection of light as well as a satisfactory driving field is obtained.



Abautolite Headlight and Sidelight.

In the A-B double-unit system the motor for starting and the generator for lighting are separate units. Without going into a detailed description of this system it is sufficient to say that it is simple and dependable. Illustrations on the preceding page show the two machines.

Illumination efficiency is the keynote of Abautolites. For 20 years the Adams-Bagnall Company has been manufacturing the highest grade of electric lighting equipment, so it was second nature, in bringing out its automobile lamps, that it should turn to the development of an efficient reflecting surface. The company's illuminating engineers have worked out lighting results that had heretofore been considered practically impossible. Every Abautolite must come up to a definite illumination standard. The Abautolite line covers head, side, dash, tail, trouble and motorcycle lamps.

A-B Trumpet.

The A-B electric trumpet is characterized by the following mechanical and electrical features: sterling silver contacts; phosphor-bronze main spring to prevent rusting or change of tension; hard steel diaphragm specially selected and heat-treated to insure molecular stability; pin riveted to diaphragm, not soldered; no exposed binding-posts or screws; no loose wire leads from coils and no soldered connections in the horn to vibrate loose, and novel method of adjustment.

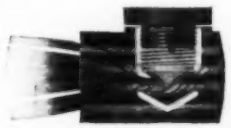
A New Approved Solderless Wire Connector.

The new insulated wire connector illustrated herewith permits a radical departure from past splicing practices. Splices made with this novel device are approved by the National Board of Underwriters and local boards without the use of solder, insulating compound or tape, under rule 16c of the National Electrical Code. Exhaustive tests have proved that it holds the wires securely without injuring them, but can instantly be removed and re-used.

The illustration makes evident how quickly and simply it can be applied. Th skinned and twisted wires are inserted as far as they will go and the conical point of the screw kinks them into the corresponding recess of the shell. After the screw has been set up, the insulated cap is screwed on with the fingers and the job is done. The reverse operation takes the joint apart and the connector can be used over and over again. Concentric grooves on the point of the screws and on the bottom of the recess help to hold the wires.

Besides being a labor-saver this connector, which has the trade name Usem connector, dispenses with solder, acid, alcohol, insulating compound and tape.

This connector is approved for splicing wire of No. 12 B. & S. gauge, or smaller, solid or stranded. Wires of the same or different sizes may be spliced with it, whether they are all solid wires, some stranded and some solid, or all stranded.



Wire Connector.

These connectors are made by the U. S. E. M. Company, 219 West Thirty-third Street, New York City.

The organization of a wireless system among the British West Indies is proceeding steadily. After successful experimenting to decide definitely whether or not communication could be established directly between Port of Spain and Tobago, it has been decided to place a wireless station at the former place.

New Dossert Rheostat Terminal.

A new terminal connector which has been substituted for the old screw-type terminals for making the connections from the dial to the grids of field rheostats in one of the largest power-generating stations of New York City is shown in the accompanying illustration. The shank of the connector is elongated so as to admit the cable in a direct line while the contact disk is slotted to fit over the grid and is offset slightly to the right or left respectively to facilitate the work of installation.

Rheostat Terminal.

The cable is held in the connector by the compression method characteristic of all types of connectors manufactured by Dossert & Company, 242 West Forty-first Street, New York City.

Cabinet Electric Beer Pump.

The Varwig Manufacturing Company, Cincinnati, O., has placed on the market a sanitary-cabinet electric beer pump, an illustration of which is shown herewith. The pump operates automatically when air pressure is required. It is stated that after it is properly adjusted a strong uniform pressure of pure filtered air is always available. No plumbing is necessary, and the entire apparatus is noiseless in operation. On the top of the cabinet there is a glass jar containing water, through which the air is drawn by vacuum. This filters and purifies the air. A small incandescent lamp lights up when the pump is in operation, adding a pleasing and attractive advertising feature. All of the working parts are enclosed in a strong cabinet with glass sides. The cabinet is 12 inches deep by 16 inches high and 23.5 inches long. The compressor is a single-cylinder, all-metal equipment, driven by belt from a small electric motor which may be supplied for either direct or alternating current.

Motor-Driven Beer Pump.

Current Electrical News

LIGHTING AND POWER.

(Special Correspondence.)

OVID, MICH.—$6,000 will be expended for a light plant. Address the city clerk.

SELMA, ALA.—The Selma Lighting Company will enlarge its electric light plant.

WAUPON, WIS.—A "White Way" will be established on the principal street of the city. C.

SPENCER, N. C.—$50,000 will be expended for a light and water system. Address the Mayor.

ORANGEBURG, S. C.—$50,000 in bonds will be expended to improve the water and light plant.

MOTT, N. D.—W. H. Stewart has been granted a franchise to establish an electric plant here.

TWIN FALLS, IDAHO.—The Beaver Light & Power Company has been granted a franchise in this city.

PHOENIX, ARIZ.—Ralph Cameron is organizing a company with a capital stock of $15,000,000 to furnish electric power.

COLORADO SPRINGS, COLO.—G. M. Boyles is interested in a proposition to secure improved electric lighting.

ROANOKE, ALA.—$20,000 will be expended rebuilding the light and water system. The Mayor has the matter in hand.

WICHITA, KANS.—Efforts are being made to secure improved electric lighting. Mayor Babb is in charge of the matter.

FLAGSTAFF, ARIZ.—The Flagstaff Electric Light Company has been granted a franchise for an electric light plant here.

LIBBY, MONT.—The Libby Water, Light & Power Company will spend about $7,000 here this summer on improvements.

EAST MOLINE, ILL.—The City Council has definitely decided to change the street lighting system from arc to tungsten lamps. Z.

UPPER SANDUSKY, O.—The Light Committee has determined to adopt the Mazda electric lighting system in this city. H.

BAY CITY, MICH.—Leo Marcus and Chauncey Grigory have been appointed a committee to secure data for improved lighting.

JETMORE, KANS.—$10,000 will be expended for a municipal light and water system. Address the city clerk for desired information.

GRAND RAPIDS, MICH.—The Council is planning to place all electric wires underground. The clerk is in charge of the matter.

DETROIT, MINN.—Detroit is preparing to install a "White Way" and, $2,500 has been subscribed toward the purchase of ornamental posts. C.

HOLLAND, MICH.—The Board of Public Works is planning to extend the boulevard lights to Eighth Street and River Avenue. Address the Mayor.

MURPHY, N. C.—$70,000 in bonds has been voted for building and equipping an electric light plant. Address D. W. Dewese, mayor, for information.

LESTER PRAIRIE, MINN.—Mr. Rutledge, of the Glencoe Electric Light Company, is working for the installation of an electric light plant here.

PIPER CITY, ILL.—The Village Board has granted a 30-year franchise to the Central Illinois Utilities Company to sell light and power in Piper City. Z.

TIMEWELL, ILL.—The Village Board has granted a franchise to the Central Illinois Public Service company of Mattoon to supply power in Timewell. Z.

WILBER, NEB.—It has been decided to issue $12,000 in bonds, part of which is for the reconstruction of the electric lighting system in the business section of the town.

YORKVILLE, ILL.—The Village Board has granted a 50-year franchise to the Public Service company of Northern Illinois, to supply light and power in Yorkville. Z.

MONTEROY, TENN.—George N. Welch, T. E. Goff and J. T. Price have been granted a franchise to establish an electric light plant here. The plant will cost about $4,000.

JOPLIN, MO.—The Council is planning to expend $75,000 in improving and extending the municipal lighting system in East Joplin. Mayor Osborn has charge of this matter.

ALEXANDER CITY, ALA.—The city is planning to construct a transmission line for alternating-current and the installation of transformer meters, etc. J. A. Coley is superintendent.

KALIDA, O.—The Kalida Electric Light Company has been incorporated with a capital stock of $10,000 by J. E. DeVoe, S. E. Shipp, A. B. DeVoe, Pearl E. DeVoe and H. D. Grindle.

MT. PLEASANT, TEX.—The Mt. Pleasant Electric Light & Power Company has announced that it will spend $175,000 in added equipment. Address the secretary for information .

LAKE LINDEN, MICH.—The street lighting system here is unsatisfactory and a tungsten-lamp system may be installed. Address the city clerk in regard to this improvement.

QUINCY, ILL.—It is reported that J. Delbar Roche, of New York, and others are interested in a project to erect a hydroelectric plant at Fall Creek gorge, 13 miles south of Quincy. Z.

PORTLAND, ORE.—The Portland Railway, Light & Power Company will expend $2,000,000 in extending its lines, purchasing new equipment, paving streets between tracks, wiring and other improvements.

BROOKLINE, MASS.—The Edison Electric Illuminating Company of Boston is about to construct underground conduits in Thorndike, St. Paul and Boylston Streets and Abbotsford Road, in this town. W.

ROGERSVILLE, TENN.—The Hydro-Electric Power Company is in the market for a 50-horsepower engine to be installed in an electric-light plant. Vance G. Hall is general manager of the company. G.

SANDUSKY, O.—The City Council has called a special election to be held July 1 for the purpose of voting upon a proposition to issue $200,000 in bonds for the construction of a municipal electric light plant. Z.

NEW ROCKFORD, N. D.—A "White Way" is being demanded by the citizens of New Rockford along with other improvements to be made in that city this spring. Address the mayor for particulars.

SAN FRANCISCO, CAL.—The Mount Konocti Light & Power Company has been granted authority to issue $20,000 in stock and a promissory note of $5,000 to be used in extending the company's lines.

HOLSTEIN, IOWA.—The Holstein Service Company has been organized here with a capital stock of $25,000, by H. A. Dessel, Glen M. Gracey and others. Steps will be taken at once to proceed with the electric-light proposition.

OLYMPIA, WASH. — The City Council recently granted Millard Lemon & Wilbur B. Forshay an electric power franchise and they propose building a power plant for the furnishing of electric power and light in this city. O.

ELLIOTT, ILL. — The Village Board has granted a 30-year franchise to the Central Illinois Utilities company to operate an electric light system. The company has been given a ten-year contract to light the streets.

RICHMOND, ILL.—The village board has granted a franchise to the Public Service Company of Northern Illinois to operate an electric lighting system in Richmond. The transmission line must be completed within six months. Z.

GLENADA, ORE.—Arrangements have been made whereby the Florence Electric Company will furnish light and power service to this city. A cable will be laid across the River and connections made with the power house in Florence. O.

BOONEVILLE, ARK.—Greenway and Harvey are planning to install additional machinery, to include 150-kilowatt generator, 225-horsepower engine, three 15-horsepower motors, two two-horsepower

motors, one 25-horsepower motor and one five-horsepower motor.

WINGATE, IND.—The installation of an electric-light system is under contemplation. Power probably will be secured from Crawfordsville. Lines may be built from Crawfordsville to supply power to Linden, New Richmond, and Waynetown. Z.

HERSMAN, ILL.—It is reported that the Central Illinois Public Service Company of Mattoon has secured enough contracts for use of electric power here to warrant the building of a transmission line and that the company will be granted a franchise to do this.

SPRINGFIELD, ILL.—The Secretary of the Springfield Pleasure Driveway and Park District has been instructed to advertise for bids for lighting the parks and boulevards. The contract with the Springfield Gas & Electric Company will expire on July 25 next.

BIG RAPIDS, MICH.—The Rapids Electric Company has been granted permission to erect a central plant. The preliminary steps are already completed and it is expected that the company will soon generate its own power and distribute it to the various users on the upper dam.

COTTAGE GROVE, ORE.—The Oregon Electric Railway Company is making estimates and investigations at the head of the McKenzie River, above Belknap Springs, where it purposes building a power plant. G. S. Edmuston, hydraulic engineer, is in charge of the work. O.

KILBOURN, WIS.—The Southern Wisconsin Power Company will build a high-voltage transmission line from Kilbourn to Portage, *via* Sauk City, Prairie Du Sac and Baraboo. Arrangements will be made for supplying each of these cities with current for light and power purposes.

LAWTON, KANS.—Two new mills are to be erected here in the near future. They will be on leases of the Eastern Lead & Zinc Company's land and will be operated by electricity. The E. S. L. & H. Company will construct one of the plants and the Lawton Mining Company the other.

TYRONE, N. M.—Phelps Dodge & Company, who own the Chemung copper mine here, will construct a large electric power plant for the purpose of providing power for operating the pumps of the mine and for running the cars through the tunnel which connects the Chemung with the Leopold mine. D.

LOUISVILLE, KY.—Motors are among the equipment to be purchased by the Commissioner of Fisheries, Washington, D. C., for the fisheries station here. Bids on the construction and equipment of a pump house, in which the motors will be installed, will be received by the commissioner at Washington, D. C., June 4. G.

ASTORIA, ORE.—Engineer Bergsvik has been instructed to investigate the feasibility of establishing a municipal lighting plant and estimate the probable cost of construction. The city owns a site eight miles below Elsie, where approximately 3,000 horsepower can be developed. It is expected the probable cost will be $300,000. O.

BAIRDSTOWN, CAL.—G. W. Baird, president of the Bairdstown Improvement Association, is actively interested in promoting the "White Way" from the mountains to the sea. The County Board of Supervisors has been authorized to advertise for bids on the construction of the lighting system along Huntington Drive from Los Angeles to Alhambra.

KAMLOOPS, B. C.—J. J. Carment, city clerk, will receive bids until June 12 for furnishing water wheels, generators, exciters, transformers and switching equipment for the proposed hydroelectric power plant under construction here. Plans and specifications may be obtained at the office of DuCane, Dutcher & Company, consulting engineers, 915 Roger Building, Vancouver, B. C. O.

WHEELING, W. VA.—Extensions of its lines on both sides of the Ohio River, new equipment and the transmission of power from the hydroelectric plant on the Cheat River, near Morgantown, W. Va., to Wheeling, are all provided for in a loan of $10,000,000, which was voted by the stockholders of the Wheeling Traction Company. Address G. O. Nagle, manager, for particulars.

EPHRATA, WASH. — William Scheffel, Salt Lake City, who recently made a filing on the Rock Island Rapids, Wenatchee River, for power purposes, is authority for the statement that Eastern capitalists will construct power sites on the filings, and that a 25,000-horsepower plant will be built at Rock Island Rapids. The Washington Water Power Company, of Spokane, is also contemplating entering this territory. O.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

PERRY, ILL.—The Pike County Telephone Company will rebuild its lines here.

VIRGINIA, ILL.—The Cass County Telephone Company will build a new toll line to Jacksonville. Z.

BROWNSVILLE, KY.—The Tartar Logan Telephone Company will build 10 to 15 miles of telephone.

CLEBURNE, TEX.—The Southwestern Telephone & Telegraph Company, will place its wires underground.

MITCHELL, S. D.—The city proposes to issue $60,000 bonds for the erection of a municipal telephone plant, it is stated. C.

SIDNEY, ILL.—The Sidney Telephone Company, will rebuild its line. Address the secretary for desired information.

ALGONA, IOWA.—Articles of incorporation have been filed for the South Cresco Telephone Company. L. F. Miller is president. C.

CHARLOTTE, N. C.—The Western Union Telegraph Company, will place its wires underground in Charlotte, at a cost of $25,000.

CARROLLTON, ALA.—The Southern Bell Telephone & Telegraph Company has been granted a franchise to construct a telephone system.

BARTLETT, TEX.—The Bartlett & Danvilla Mutual Telephone Company will extend its lines from Florence, Jarrell, Holland and other cities.

TACOMA, WASH.—The matter of establishing a municipal telephone company is under consideration. Address Mayor W. W. Seymour for particulars.

KENTON, O.—The Kenton Telephone Company, has increased its capital stock from $175,000 to $200,000 and will erect a large addition to its plant in this city. H.

STUART, VA.—Carolina Mutual Telephone Company has been incorporated with a maximum capital stock of $4,968. A. J. Ayers of Nettle Ridge, Va., is president.

PEORIA, ILL.—The Central Union Telephone Company will rebuild the entire Peoria, Canton-Lewistown pole line and string additional copper wire, at a cost of $44,000.

EAU CLAIRE, WIS.—Citizens' Telephone Company has been incorporated with a capital stock of $60,000 by David Drummond, Robert E. Parkinson and R. R. Chase.

CARROLLTON, ALA.—The Southern Bell Telephone & Telegraph Company has been granted a franchise to construct and maintain telephone lines here. Jack M. Pratt, mayor, has charge of the matter.

BURTON, TEX.—The Burton Telephone Company has been organized here. It will establish a local exchange. The incoporators are C. W. Homyer, T. J. Awalt, Thomas Watson and others. D.

GUTHRIE, OKLA.—Guthrie Southwestern Telephone Company has been incorporated with a capital stock of $200. The incorporators are W. N. Kellogg, C. P. James and L. J. Hirzel, all of Guthrie.

VANCOUVER, B. C.—The British Columbia Telephone Company is preparing to spend $20,000 in extensions to its Nanaimo branch and $120,000 in laying a submarine cable between Vancouver and Nanaimo. O.

COLFAX, WASH.—The Moys Telephone Company has been incorporated for rebuilding and repairing the farmer's line. J. J. Miller is president, and John Bloom, secretary-treasurer and manager.

JEFFERSONVILLE, IND.—Jeffersonville Home Telephone Company has been incorporated with a capital stock of $10,000 for the purpose of operating telephone lines, etc. The incorporators are F. J. Beaucond, P. S. Pogue and V. E. Furnas.

WRIGHTSTOWN, WIS. — The Wrightstown Telephone Company has filed articles of incorporation. The incorporators are E. A. Perkins, of Bertha; F. Townby, of Wrightstown; R. V. Smith, of Perker's Prairie. The capital is $10,000. C.

SAN FRANCISCO, CAL.—Provision will be made in the forthcoming budget, now being prepared by the Finance Committee of the Supervisors, for beginning the work of the construction on the central station for the fire-alarm and police telegraph and telephone systems of the city in Jefferson Square.

MOUNTAIN HOME, IDAHO.—The Nevada-Idaho & Western Telephone & Telegraph Company, headed by W. D. Reynolds and C. B. Faraday, of this city, contemplate the immediate extension of their lines in Owyhee County. The organization recently took over the lines built by the Murphy Irrigation Company. O.

ELECTRIC RAILWAYS.

(Special Correspondence.)

SANTA BARBARA, CAL.—Bids will be received until June 12 for a franchise to construct and maintain a street railway in this city.

WILMINGTON, DEL.—The Iowa Midland Electric Railway Company has been incorporated for $1,000,000 by R. Boyd Cooling, of Wilmington, Del. N.

DAYTON, O.—The Middletown, Cincinnati & Reading Interurban Railway Company has concluded to extend its line to Dayton, and engineers are now preparing a survey. H.

CLARKSTON, GA.—The Georgia Railway & Power Company, of Atlanta has been granted a franchise to build an electric line from Atlanta to Stone Mountain, Ga.

INDEPENDENCE, KANS. — The Independence Neodesha & Topeka Traction Company plans to begin work on line to Topeka. Address A. F. Squires of Neodesha, for information.

LOS ANGELES, CAL.—The Pacific Electric Railway Company is considering building an electric line connection between Long Beach and Redondo. The line will form an 18-mile extension of the Rendondo Beach road.

VENICE, FLA.—The Charlotte Harbor & East Coast Electric Railway Company will build an electric line 26 miles long from Venice, Fla., to Charlotte Harbor, *via* Salt Spring. W. J. Bowling, of St. Louis, Mo., is president of the company.

LEWISTON, IDAHO.—Citizens of this city have subscribed $90,000 to be used in the construction of an electric road being promoted by F. L. Sturm and associates. The line will be built from Lewiston to the Lewiston Orchards, *via* Normal Hill. O.

COLUMBUS, O.—A new company to be known as the Columbus, Marion & Bucyrus Interurban Railway Company is to be founded on the wreckage of the Columbus, Marion & Bucyrus Railway Company. The new company will have a capitalization of $250,000.

AUSTIN, TEX.—Advices have been received by the State Railway Commission that construction of a railroad to run from Ennis to a connection with the Trinity & Brazos Valley at either Bardwell or Emhouse is being promoted. This line will be about 50 miles long.

FRESNO, CAL.—It is announced that the Fresno Traction Company will begin at once the construction of an interurban electric line to the San Joaquin River. The line will be nine miles in length, and rights of way over private property have already been secured.

MIAMI, FLA.—The Miami & South Florida Electric Railway Company, with a capital stock of $500,000, will build a line from Palm Beach southward *via* this city to Homestead and Detroit, Fla., a distance of about 100 miles. H. C. Roome is president of the company.

FREEPORT, ILL.—The Stephenson County Board of Supervisors has granted a 20-year franchise to the Freeport Railway & Light Company to construct, maintain and operate a street railway system through the towns of Florence and Harlem. This gives the company a line to Krape Park which probably will be purchased by the city. Z.

HARRISBURG, PA.—The following electric railway charters have been granted: The Shenandoah and Wiggans Street Railway Company, Schuylkill County, capitalized at $25,000; by Albert B. Raiguel, Glenside, Pa.; The Schuylkill County Railway Company, Schuylkill County, capital $25,000, by Clayton Newbold, Philadelphia, Pa. N.

ALBIA, LA.—At a special meeting of the Albia Business Men's Association the project of extending the interurban lines to Buxton was indorsed. It will require $125,000 to build the road, and of this amount, the people of Albia will subscribe $25,000. For building interurbans to Hiteman and Hocking, nearby mining towns, the people of Albia have already invested $65,000.

MEMPHIS, TENN.—B. G. Sargent, vice-president and general manager of the West Tennessee Traction Company, states that financial arrangements to build the line from Memphis *via* Brownsville to Jackson, Tenn., are about completed. The line is to be 85 miles long and will cost $2,000,000. Associated with Mr. Sargent in the construction of this line is George C. Bennett, president of the company. W. W. Swift of Memphis is secretary and treasurer.

SAN FRANCISCO, CAL. — The Exposition Terminal Railway Company has been incorporated with a capital stock of $100,000 by J. W. Hellman, Jr., James McNab, William H. Crocker, Henry F. Fortmann and Leon Sloss. The object of the incorporation is to operate a railroad on the exposition grounds at Harbor View for the transportation of exhibits and materials from the freight slips of the exposition to the various exhibit palaces and buildings. The road will be about ten miles long.

NEW INCORPORATIONS.

PHILADELPHIA, PA.—West Calm Electric Company has been incorporated with a capitalization of $5,000. N.

HAMILTON, TEX.—Hamilton Mill & Power Company has been incorporated with a capital stock of $30,000 by H. M. Wieser, C. E. Horton and W. B. Claunch.

CINCINNATI, O.—The Cincinnati Power Company has been incorporated with $10,000 capital stock for the purpose of supplying electricity for power, light and heat.

CLEVELAND, O.—The United Electric Fixture & Supply Company has been incorporated with a capitalization of $10,000 by Fred Derberg. M. J. Roan, I. Grohs and F. C. Murman.

NEW YORK, N. Y.—The Enterprise Electric Company has been incorporated under the laws of Delaware with a capital of $5,000. D. A. Gashan, this city is the principal incorporator.

NEW YORK, N. Y.—C. D. Wood Electric Company, Incorporated, has been incorporated with a capital stock of $20,000 by Louis A. Seitz, C. D. Wood and Kenneth Wheeler, all of New York City.

CHICAGO, ILL.—Electric Maintenance Company has been incorporated with a capital stock of $50,000 to deal in automobile supplies. The incorporators are W. B. Christie, C. E. Winters and W. A. Baehr.

LADONIA, TEX.—J. A. Bishop & Company has been incorporated with a capital stock of $15,000 for the purpose of merchandising and manufacturing of ice, power, etc. The incorporators are J. A. Bishop, Grover Bishop and W. W. Bomar. Z.

NEW YORK, N. Y.—Electrical Expirement Company, Incorporated, has been incorporated with a capital stock of $10,000 by E. Mortimer Boyle, Alfred W. Haywood, Jr., of New York City, and Edward G. S. Hudson, of Brooklyn, N. Y.

CHICAGO, ILL.—The John Friedman Construction Company has been incorporated with a capital stock of $10,000 to do electric construction and contracting work. The incorporators are Louis Becker, Irving Zimmerman and William Frank Linn. Z.

NEW YORK, N. Y.—Charles Cory & Son, Incorporated, has filed articles of incorporation with a capital stock of $100,000 and will deal in electrical equipment for ships. The incorporators are John M. Cory, Charles Cory and Ella Cory, of New York City.

NEW YORK, N. Y.—Greater New York Electric Protective Company, Incorporated, has filed articles of incorporation with a capital stock of $1,000. The incorporators are Philip C. Stone, of New York City, and Max Kivowitz and Rebecca Goldstein, both of Brooklyn.

OMAHA, NEB.—The Fremont Power & Canal Company has filed articles of incorporation with a capitalization of $100,000, for the purpose of furnishing electric power. The incorporators are Osgood T. Eastman, Irving Allison, Charles A. Grimmel, James M. Kenna and Martin W. Dimmery.

NEW YORK, N. Y.—Collins Switch & Signal Company, Incorporated, has filed articles of incorporation with a capital stock of $15,000. The company will manufacture and install electric signal systems. The incorporators are James J. Laing, New York City; Oscar J. Heig, Woodhaven, and Philip Huetwohl, of Brooklyn.

LOUISVILLE, KY.—The Foundation Company has been incorporated with $2,000 capital stock. The articles authorize it to manufacture, sell and transmit light, heat and power. The incorporators are D. Long Miller, George G. Fetter and others, Mr. Miller being the chief mover in the enterprise. It is understood that a suburban lighting project is to be promoted. G.

NEW PUBLICATIONS.

WATER-POWER PLANTS.—Stone and Webster Engineering Corporation, Boston, Mass., has issued a booklet containing views of the various water-power plants which have been installed by this company. It includes six plants using heads of less than 100 feet, four plants with medium heads and the plants at Big Creek and Puyallup, both of which have heads of over 500 feet.

PRODUCER-GAS PLANTS. — The Bureau of Mines, Washington, D. C., has published bulletin No. 55 entitled "The Commercial Trend of the Producer-Gas Power Plant in the United States," by R. H. Fernald. This discusses the present status of the producer-gas plant, gives detailed notes on inspection of various plants and a table of the installations in the United States.

FINANCIAL NOTES.

The officers of the General Electric Company have been re-elected.

The Pacific Gas & Electric Company's application to the California Railroad Commission for authority to issue the $6,000,000 10-year, six-per cent debentures recently authorized by stockholders has been approved.

The Ottawa Light, Heat & Power Company will issue $800,000 new stock at par. A bonus of one per cent has been declared payable July 1.

Stockholders of the Boston Suburban Electric Company at a special meeting authorized the issue of $2,000,000 nine-year notes, with interest not exceeding five per cent per annum. These notes are to be issued to retire preferred shares at a price considered reasonable by the trustees.

Dividends.

American Telegraph & Cable Company; the regular quarterly dividend of 1.25 per cent, payable June 2 to stock of record May 31.

Baton Rouge Electric Company; a semi-annual preferred dividend of $3 per share, payable June 2 to stock of record May 21.

Blackstone Valley Gas & Electric Company; a quarterly common dividend of two per cent, and a preferred dividend of three per cent, payable June 2 to stock of record May 21.

Chicago Elevated Railways; the regular quarterly dividend of 1.5 per cent on the preferred participation certificates, payable June 2 to stock of record May 22.

Cities Service Company; the regular monthly dividends of one-half of one per cent on its preferred stock and five-twelfths of one per cent on its common stock, payable June 2 to stock of record May 15.

Detroit Edison Company; regular quarterly dividend of 1.75 per cent, payable July 15, to stock of record July 1.

General Electric Company; the regular quarterly dividend of two per cent, payable July 15 to stock of record May 31.

New York & Queens Electric Light & Power Company; the regular quarterly dividend of one per cent on the preferred stock, payable June 2 to stock of record May 23.

Norfolk Railway & Light Company; a semi-annual dividend of three per cent, payable June 10 to stock of record May 31.

Northern Ohio Traction & Light Company; a quarterly common dividend of 1.25 per cent, payable June 15 to stock of record May 31.

Standard Gas & Electric; quarterly dividend of two per cent, payable June 15 to stock of record May 31.

United Light & Railways Company; a common quarterly dividend of one per cent, payable July 1 to stock of record June 21.

Utilities Improvement Company; the regular monthly dividends of one-half of one per cent on its preferred stock, and one-sixth of one per cent on its common stock, payable June 2 to stock of record May 15.

Virginia Railway & Power Company; the regular semi-annual dividend of 2.5 per cent on its preferred stock, payable July 10 to stock of record of June 14.

Reports of Earnings.

PHILADELPHIA COMPANY.

The report of the Philadelphia Company of Pittsburgh for the year ended March 31, 1913, shows net earnings of $3,901,077, a decrease of $66,798. The balance after preferred dividends was $3,111,675, equal to 7.96 per cent on the common stock, as compared with 10.86 per cent earned the previous year. The company sold during the year 40,542,825,500 cubic feet of natural gas, being an increase of 2,973,048,000 cubic feet, with increased receipts from that source of $285,990. The income account for the fiscal year compares as follows:

	1913	Increase
Gross earnings	$ 7,052,277	$ 433,753
Oper. expenses and taxes	3,151,200	500,551
Net earnings	$ 3,901,077	*$ 66,798
Other income	2,354,651	*414,181
Total income	$ 6,255,728	*$ 480,979
Charges	1,638,775	350,575
Balance	$ 4,616,953	*$ 831,554
Improvements, betterments, etc.	1,198,811	281,172
Balance	$ 3,418,142	*$1,127,726
Preferred dividends	306,467	6,467
Balance	$ 3,111,675	*$1,119,103
Common dividend	2,729,967	8,769
Balance	$ 381,708	*$1,127,962
Previous surplus	5,394,152	331,558
Total surplus	$ 5,775,860	*$ 796,404
Miscellaneous credit	9,789,902	9,789,902
Total	$15,565,762	$8,993,498
Miscellaneous deductions	9,798,162	8,620,051
Profit and loss surplus	$ 5,767,600	$ 373,447

*Decrease.

The report says: "The company has acquired and now owns, as representing its entire investment in electric light and power companies, all the outstanding capital stock of the Duquesne Light Company to the par value of $20,884,200, a moderate dividend upon which would provide the interest upon the total funded debt of the Philadelphia Company. The Duquesne Light Company has declared and paid its initial dividend of 1.75 per cent on said $20,884,200 for the quarter ended March 31, 1913, being at the rate of seven per cent per annum."

VIRGINIA RAILWAY & POWER.

The Virginia Railway & Power Company reports to the New York Stock Exchange for the nine months ended March 31, 1913, as follows:

Gross earnings	$3,630,511
Operating expenses (including depreciation	1,813,920
Net earnings	1,816,591
Other income	63,149
Gross income	1,879,740
Charges, taxes, etc.	1,117,232
Surplus	762,507
Preferred and common stock dividends	491,229
Deferred charges, etc.	17,447
Net surplus	253,830
Previous surplus	924,307
Profit and loss surplus	1,178,138

WASHINGTON RAILWAY & ELECTRIC.

The Washington Railway & Electric Company reports for the year ended December 31, 1912, compared as follows:

	1912.	1911.
Gross earnings	$4,648,328	$4,352,671
Expenses and taxes	2,528,224	2,410,204
Net	2,120,104	1,942,467
Other income	13,233	.....
Total income	2,133,337	1,942,467
Fixed charges	1,107,607	1,091,559
Surplus	1,025,730	850,908
Preferred dividends	425,000	425,000
Surplus	*600,730	425,908
Common dividend	260,000	130,000
Surplus	340,730	295,908

*Equal to 9.24 per cent on $6,500,000 common stock, as compared with 6.56 per cent earned on same stock in previous year.
†Taxes included in charges in 1909.

NEW ORLEANS RAILWAY & LIGHT COMPANY.

The New Orleans Railway & Light Company make the following report for the year ended December 31, 1912:

Operating revenue	$6,628,147.57
Operating expenses	3,420,356.42
Net operating revenue	$3,207,791.15
Revenue deductions—taxes, etc.	565,990.70
Net operating income	$2,641,800.45
Miscellaneous income and revenue outside operations	41,573.83
Gross income	$2,683,374.28
Income deductions — interest, etc.	1,688,341.57
Net income	$ 995,032.71

These figures compared against the previous year's result will show the following: Gross operating revenue increased $292,685.34, or 4.60 per cent; net operating revenue increased $291,977.74, or 10.01 per cent; net income increased $223,336.35, or 28.95 per cent.

NIAGARA POWER COMPANY.

The report of the Niagara Falls Power Company for the year ended December 31, 1912 (including income of the Canadian Niagara Power Co.), shows net earnings of $2,032,099, against $1,802,826 in 1911. The balance available for dividends was $927,858, equal to 16.1 per cent on the capital stock outstanding, as compared with 11.92 per cent the previous year. The consolidated income account compares as follows:

	1912	1911
Gross	$2,497,196	$2,246,413
*Expenses	465,097	443,587
Net	$2,032,099	$1,802,826
Other income	148,563	173,020
Total income	$2,180,663	$1,975,846
Charges, taxes, etc.	1,252,805	1,288,923
Surplus	$ 927,858	$ 686,923
Dividends	460,616	429,412
Surplus	$ 467,242	$ 257,511

*Includes $100,000 charged in respect of obsolescence, and a reserve against extraordinary casualties.

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	May 26.	May 19.
American Tel. & Tel. (New York)	129½	128
Commonwealth Edison (Chicago)	*132	132
Edison Electric Illuminating (Boston)	260	261
Electric Storage Battery common (Philadelphia)	47½	47¼
Electric Storage Battery preferred (Philadelphia)	47½	47¼
General Electric (New York)	139¾	138
Kings County Electric (New York)	129	129
Manhattan Transit (New York)	1½	1½
Massachusetts Electric common (Boston)	15⅛	16
Massachusetts Electric preferred (Boston)	72½	73
National Carbon common (Chicago)	116	116
National Carbon preferred (Chicago)	115	115
New England Telephone (Boston)	142	142
Philadelphia Electric (Philadelphia)	22⅝	23⅝
Postal Telegraph and Cables common (New York)	81	81
Postal Telegraph and Cables preferred (New York)	65⅞	66
Western Union (New York)	66	65
Westinghouse common (New York)	62½	61
Westinghouse preferred (New York)	111	105

*Last price quoted.

INTERNATIONAL RAILWAYS OF BUFFALO.

The report of the International Railway Company, of Buffalo, to the upstate New York Public Service Commission, for the quarter ended March 31, 1913, compares as follows:

	1913	1912
Gross	$1,546,267	$1,438,588
Net after taxes	501,790	383,275
Other income	7,809	16,204
Total income	509,598	399,479
Surplus after charges	200,751	139,378

MONTHLY EARNINGS STATEMENTS. SOUTHERN CALIFORNIA EDISON COMPANY.

	1913	1912
March gross	$ 351,702	$ 329,199
Net after taxes	163,340	158,311
Surplus after charges	94,831	96,465
Balance after preferred dividends	78,164	79,164
Three months gross	1,108,937	1,046,712
Net after taxes	516,558	528,823
Surplus after charges	311,761	345,950
Balance after preferred dividends	261,780	296,949

KEYSTONE TELEGRAPH OF PHILADELPHIA.

	1913	1912
April gross	$103,880	$100,110
Net after taxes	50,778	50,180
Surplus after charges	25,492	25,218
Four months gross	414,243	394,427
Net after taxes	202,788	196,752
Surplus after charges	101,565	96,671

EDISON COMPANY OF BOSTON.

	1913	1912
April gross	$ 541,548	$ 480,207
Net	309,560	275,803
Four months gross	5,388,209	4,910,747
Net	3,120,742	2,940,678

AMERICAN GAS & ELECTRIC COMPANY SUBSIDIARIES.

The subsidiaries of the American Gas & Electric Company report earnings for April and twelve months ended April 30, 1913, compared as follows:

Canton Electric.

	1913	1912	Increases
April gross earnings	$ 31,958	$ 27,358	$ 4,600
Net earnings	16,504	14,126	2,378
Surplus after charges	11,723	9,370	2,353
Twelve months gross earnings	358,087	322,571	35,516
Net earnings	178,366	161,451	16,915
Surplus after charges	121,706	104,680	17,026

Muncie Electric Light.

April gross earnings	$ 38,598	$ 32,900	$ 5,698
Net earnings	17,369	14,097	3,272
Surplus after charges	10,337	7,724	2,613
Twelve months gross earnings	417,450	333,247	84,203
Net earnings	178,458	143,914	34,544
Surplus after charges	94,366	70,471	23,895

Rockford Electric.

April gross earnings	$ 36,873	$ 34,603	$ 2,270
Net earnings	19,926	16,462	3,464
Surplus after charges	11,840	8,645	3,195
Twelve months gross earnings	430,036	398,539	31,497
Net earnings	218,244	190,845	27,399
Surplus after charges	123,700	98,258	25,442

Scranton Electric.

April gross earnings	$ 75,194	$ 65,006	$10,188
Net earnings	46,606	38,186	8,420
Surplus after charges	29,292	26,159	3,133
Twelve months gross earnings	839,827	759,047	80,780
Net earnings	494,282	430,455	63,827
Surplus after charges	332,360	289,628	42,732

Wheeling Electric.

April gross earnings	$ 25,633	$ 20,347	$ 5,286
Net earnings	12,558	10,476	2,086
Surplus after charges	7,528	6,437	1,091
Twelve months gross earnings	276,285	234,752	41,532
Net earnings	126,189	112,630	7,559
Surplus after charges	62,529	73,888	*11,359

*Decrease.

PERSONAL MENTION.

LLOYD MEDLAR has been appointed manager for the Interstate Telephone Company at Morrison, Ill.

J. S. MAGLADRY, of Eugene, Ore., has been made a director in the Oregon Electric Railroad Company.

WALTER C. JONES, who was recently appointed general manager of the Utah Light & Power Company, has resigned to accept the position of general sales manager of the American Felt Company with headquarters in Chicago.

EDWIN R. ROCKWELL, formerly president of the Guarantee Electric Company, Chicago, announces the formation of the Rockwell Electric Company for the handling of electrical machinery. Offices have been established in the First National Bank Building, Chicago.

H. W. YOUNG, president of Delta-Star Electric Company, Chicago, read a paper entitled "Recent Types of Outdoor Substations" at the meeting of the Detroit—Ann Arbor Section, American Institute of Electrical Engineers, held at Ann Arbor, Mich., on May 24. The paper was illustrated by lantern slides.

W. W. S. BUTLER, vice-president and general manager of the Western States Gas & Electric Company, has resigned and will be succeeded by SAMUEL KAHN, who has been assistant Pacific Coast manager for H. M. Byllesby & Company. B. F. WELLINGTON, JR., who has been auditor of the company, has been appointed to succeed Mr. Kahn as assistant Pacific Coast manager.

JOHN E. WILKIE, ex-chief of the Secret Service and Customs Agents, has resigned to become assistant to HENRY A. BLAIR, chairman of the board of the Chicago Railways Company. He will take up his duties some time in June. In accepting Mr. Wilkie's resignation, Secretary McAdoo said, "I regret your determination to quit the service, as I had looked forward to a continuance of your work in the department. But I can readily understand your desire to take advantage of the business offer which you tell me is the occasion for your resignation."

P. T. GLIDDEN, for the past year and a half manager of the Louisville Lighting Company, one of the leading properties of H. M. Byllesby & Company, has been appointed manager of the Consumers' Power Company, of St. Paul, Minn. Mr. Glidden will be succeeded by HERBERT L. HARRIES, a son of GEORGE H. HARRIES, president of the Louisville Lighting Company, who will be given the title of assistant to the president. The new appointee is a West Point and Boston Tech. graduate, and has been in charge of the George G. Fetter Light, Heat & Power Company and the Campbell Electric Company since those Louisville plants were purchased by H. M. Byllesby & Company.

OBITUARY.

A. MARTIN ALLEN, superintendent of mailing in the department of archives of the American Telephone Company, died at Wilmington, Mass., on May 23. He had been in the service of telephone interests for 33 years.

GEORGE G. CROCKER, chairman of the Boston Transit Commission, died at Cohasset, Mass., on Monday, May 26. Mr. Crocker was a member of the Railroad Commission from 1887 to 1892, and a member of the Transit Commission since 1894.

GEORGE D. ROSENTHAL, district manager for the General Electric Company at St. Louis, Mo., died May 19 in the German Hospital in New York City. Mr. Rosenthal was operated on for appendicitis May 12 and suffered a fatal relapse a week later. The late Mr. Rosenthal had been connected with the General Electric Company for nearly 25 years. He was born in New York city 45 years ago. His father was chief statistician for the Thomas A. Edison Lamp Works at Harrison, N. J., before it was consolidated with the General Electric Company. Mr. Rosenthal began his business career with the Edison Company as a lamp salesman. After its consolidation with the General Electric Company he went to the Chicago office of the new company as a salesman for railway apparatus. About 15 years ago he was transferred to the St. Louis office. He was one of the best salesmen in the organization and gradually worked up to the position of district manager. He is survived by his wife, Josephine Murphy Rosenthal.

PROPOSALS.

CONDUIT, WIRE AND CABLE.—Sealed proposals will be received at the office of the Chief Signal Officer, War Department, Washington, D. C., until June 2 for furnishing conduit under Proposal 654, and until June 7 for furnishing wire and cable under Proposal 665.

ELECTRIC ELEVATOR.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until June 16 for an electric elevator in the post office at Jersey City, N. J., in accordance with drawing and specifications, copies of which may be obtained from the office of the Supervising Architect.

ELECRICAL SUPPLIES.—Sealed proposals will be received at the office of the Secretary of the Board of Public Education, Pittsburgh, Pa., until June 2 for furnishing electrical supplies, etc. Bidding blanks and specifications may be obtained from the Superintendent of Supplies, 703 Fulton Building, Pittsburgh.

CONDUIT AND WIRING SYSTEM.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until June 9 for a conduit and wiring system in the Marine Hospital at San Francisco, Cal., in accordance with drawings and specifications, copies of which may be obtained from the Supervising Architect.

ELECTRIC ELEVATOR.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until June 10 for the installation complete of an electric passenger elevator in the post office at Providence, R. I., in accordance with drawing and specification, copies of which may be obtained from the Supervising Architect.

ELECTRICALLY DRIVEN CAPSTANS.—Sealed proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until June 14, for furnishing and installing three electrically-driven capstans at the Navy Yard, Philadelphia, Pa., at an estimated cost of $9,000. Plans and specifications may be obtained upon application to the Bureau or to the commandant of the navy yard.

ELECTRICAL EQUIPMENT.—Sealed proposals will be received by

the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until June 10 for furnishing miscellaneous equipment, transformers, etc., five electric hoists and a large number of motor-driven machines, for delivery at the Navy Yard, Pearl Harbor, as per Schedule 5,467, and until June 17 for one turret lathe, motor-driven, for delivery at the Navy Yard, Puget Sound, Wash., as per Schedule 5,477.

ELECTRIC CONDUIT AND WIRING AND INTERIOR LIGHTING FIXTURES.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until June 23 for furnishing the electric conduit and wiring and interior lighitng fixtures of a two-story building for the post office at Moorhead, Minn., and until June 24 of a two-story building for the post office at Grand Junction, Colo. Drawings and specifications may be obtained from the custodians of the sites or from the Supervising Architect.

DATES AHEAD.

Society for Electrical Development. Annual meeting, Hotel Sherman, Chicago, Ill., June 2.

National Electric Light Association. Annual convention, Medinah Temple, Chicago, Ill., June 2-6.

National Electrical Credit Association. Annual convention, University Club, Chicago, Ill., June 4.

American Institute of Electrical Engineers. Annual convention, Hotel Otesaga, Cooperstown, N. Y., June 23-27.

Society for the Promotion of Engineering Education. Annual convention, Minneapolis, Minn., June 24-26.

Canadian Electrical Association. Annual convention, Toronto, Ont., June 25-27.

Electrical Contractors' Association of the State of Missouri. Annual meeting, St. Louis, Mo., July 12.

National Electrical Contractors' Association. Annual meeting, Chattanooga, Tenn., July 16-19.

Michigan Section, National Electric Light Association. Annual convention, Ottawa Beach, Mich., August 18-21.

With the Electrical Manufacturers

The Opalux Company, New York City, has removed its offices to the Masonic Building, 71 West Twenty-third Street.

Delta-Star Electric Company, Chicago, Ill., has issued bulletin No. 4 describing the type S phase-rotation indicator for portable service. This is a direct-reading instrument for indicating the direction of phase rotation in polyphase circuits.

Rockwell Electric Company, Chicago, has been organized for the handling of electrical machinery. The company is headed by Edwin R. Rockwell, formerly president of the Guarantee Electric Company, of Chicago. It has offices in the First National Bank building.

New York Insulated Wire Company, 114 Liberty Street, New York City, has issued price booklet No. 23 covering Raven Black Core, single and double-braided, solid and stranded wires. Prices are given for various wire bases ranging from 12 to 20 cents. Data on freight additions are also given.

Beardslee Chandelier Manufacturing Company, Chicago, in the May number of its *Beardslee Talks,* which has come to be well known as its monthly house organ, gives an interesting article entitled "The Chandelier Maker," and includes about a half-dozen attractive designs of semi-indirect lighting fixtures.

The Lansden Electric Truck Company, of Newark, N. J., has announced that it will move its plant to Allentown, Pa., shortly. The new home of the Lansden, in which a number of Allentown capitalists and investors are interested, will be at the plant of the Webb Company and the MacCarr Company.

The American Steel & Wire Company in a recent issue of the *American Wire Wheel News,* has published a complete résumé of the art of making wire wheels for automobile use. This information is of very great interest and usefulness to a wide range of readers, and copies will be sent to those interested upon request.

F. W. Wakefield Company, Vermilion, O., has issued a folder calling attention to its standard line of universal lighting fixtures as among the most active sellers in the fixture line. Mention is also made of the Wakefield patent ceiling attachment which has been found a great time and labor-saving device for mounting fixtures.

Reynolds Electric Flasher Manufacturing Company, Chicago and New York, has issued bulletin No. 26. This describes the new Reco time switch. This is a one-day switch adapted for the control of signs, show-window lights, isolated street lamps, store or hall lights, etc. The switch is of compact design and strong but inexpensive construction.

The Hemming Manufacturing Company, Garfield, N. J., announces that owing to the steady increase in the demand for its heat-resisting molded insulation, the business has outgrown its present plant to such an extent that it has been found necessary to treble the capacity. Contracts for the necessary buildings and equipment have been let and will be rushed to completion.

The Munning-Loeb Company, Matawan, N. J., announces that it has obtained exclusive rights for the manufacture and sale of the "None-Such" single-cylinder and double-cylinder rotating plating barrel, covered by patents of S. D. Catlin and formerly sold by Rockhill & Vietor. These machines are now being manufactured at the plant of the Munning-Loeb Company, and several new features have been incorporated. The Munning-Loeb Company also announces that it has acquired the sale and manufacturing rights of the "None-Such" carboy rocker.

The Adams-Bagnall Electric Company, Cleveland, has issued a number of new catalogs, of which No. 120 is devoted to street-lighting equipment, notably series flame-arc lamps, series constant-current transformers, series panelboards, and series Mazda equipments such as brackets, center span suspensions, street hoods and reflectors. Catalog No. 123 describes the Entz system for electric starting and lighting of gasoline automobiles, mentioning also the line of Abautolites and the A-B trumpet. Catalog No. 121 describes the A-B regenerative flame lamps of the focusing type; these lamps are made for direct-current multiple, direct-current multiple-series, and alternating-current multiple circuits.

Chicago Pneumatic Tool Company, Chicago, Ill., has issued bulletin No. 34 L. This gives general information in pneumatic engineering of value to all users of compressed-air devices. It contains tables giving efficiencies of air compressors at different altitudes, densities of gases and vapors, mean-effective pressures and horsepowers, loss of pressure due to friction in pipes and many other data, some rare and hitherto unpublished. There is also included information for intending purchasers of compressor equipments, showing the data required for intelligent estimates. Views of various types of compressors manufactured by the company are shown, as well as illustrations of the interior of the company's works at Franklin, Pa.

The General Bakelite Company, 100 William Street, New York City, announces that, as a result of negotiations between it and the Condensite Company of America, the suits brought by the former against the latter for alleged infringement of the Bakelite patents, have been withdrawn and the Condensite Company has acknowledged the validity of the Bakelite patents and will pay substantial royalty thereunder. The Condensite Company will manufacture Condensite under the Aylsworth patents as well as the license just granted for such of the Baekeland patents as are broad enough to cover Condensite. The General Bakelite Company feels gratified over this confirmation of the breadth of scope and pioneer character of its patents.

The Lloyd-Thomas Company, appraisers and engineers, with offices at 4727 Evanston Avenue, Chicago, and 27 William Street, New York, has expanded its organization to include electrical engineering and appraisals, with special consideration given to appraisals of public utilities. F. M. Lloyd,

president, and J. J. Thomas, secretary and treasurer, are both men of wide experience in the appraisal field. The electrical engineering department, just organized, is under the supervision of W. W. Anderson, formerly with the Arnold Company, where he was prominently connected with the appraisal of the Chicago Telephone Company's property, and later acted as expert for the City of Lincoln, Neb., in a case involving an increase in rates applied for by the Lincoln Telephone & Telegraph Company.

The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has issued bulletin No. 8502. This describes the latest type of Simplicity theater dimmers for two-wire and three-wire circuits. These dimmers are made especially for use with tungsten lamps and where an extremely fine regulation of the lamp brilliancy is desired. There are twice as many steps on the new plates as on the dimmers for carbon-filament lamps. The diameter of the plates has also been increased two inches and two complete resistance windings can be carried on each side of the plate. These plates, however, can be carried on the same frame as the smaller ones. The bulletin contains very complete descriptions and has many illustrations. Means of banking and control are discussed and dimensions given. The new Medinah Temple and Auditorium, of Chicago, and a number of eastern theaters already equipped with these dimmers are also described in this bulletin.

The Bristol Company, Waterbury, Conn., has issued a number of new bulletins, of which Nos. 143 and 173 deal with recording differential-pressure gauges and recording flow-rate meters. The former of these bulletins is particularly complete in giving descriptions of the apparatus together with many illustrations of its construction, typical record charts, etc. Bulletin No. 170 is devoted to Bristol's patent electric furnaces for soldering coppers; these are made for either direct current or alternating current and for 110 or 200-volt circuits; they are particularly designed for heating soldering coppers and maintain constantly a suitable temperature. Catalog No. 1,300 gives a complete presentation of data, illustrations, diagrams, charts, etc., of Bristols Class III recording thermometers. These are suitable for temperatures between 60 degrees below zero and 800 degrees Fahrenheit. These recording thermometers depend for their operation on the expansion of a gas.

Record of Electrical Patents.

Issued by the United States Patent Office, May 20, 1913.

1,061,985. **Apparatus for Indicating and Recording the Speed of Ships.** A. J. Cooper, Totland Bay, Isle of Wight, England. A cylinder placed in the skin of the ship has its piston acted on by pressure of water and thereby actuates electrical indicating mechanism.

1,061,989. **Trolley-wheel Construction.** H. Cutler, Pittsburg, Pa. Has guard arms over each side of the wheel.

1,061,992. **Trolley-wire Splice.** W. J. Dukro, Lima, O. A special trolley car.

1,062,004. **Telephone System.** R. C. M. Hastings, assignor to International Telephone Co., Columbus, O. A selective-lockout system for party lines.

1,062,009. **Typewriting Machine.** B. F. Hutches, Jr., assignor to Underwood Typewriter Co., New York, N. Y. Has key-controlled means for regulating the driving motor's speed.

1,062,031. **Electric Meter.** W. H. Pratt, assignor to General Electric Co. Describes the arrangement of disk armature potential coils and special magnetic circuit therefor.

1,062,046. **Electrical Apparatus.** H. B. Smith, assignor to Westinghouse Electric & Mfg. Co. A high-tension transformer with conducting barrier plates in parallel planes between the coils, thus constituting a set of condensers of equal capacity.

1,062,052. **Overspeed Device for Dynamo-Electric Machines.** H. G. Stott, assignor to Westinghouse Electric & Mfg. Co. The direct-current circuit-breaker of a rotary converter is opened when excess speed is developed.

1,062,058. **Electrolytic Cell.** R. Threlfall, Birmingham, England. Includes intermediate electrodes arranged to circulate the electrolytic and permit escape of products.

1,062,075. **Fastening Device.** L. H. Arens, assignor to Frank Adam Electric Co., St. Louis, Mo. For clamping the face plate to the wall of a switch box or cabinet.

1,062,082. **Telephone Receiver.** E. B. Craft and J. N. Reynolds, assignors to Western Electric Co. A soft-iron pole piece is welded to a permanently magnetized steel bar.

1,062,083. **Storm and Surge Alarm for Transmission Lines.** E. E. F. Creighton, assignor to General Electric Co. A coherer insensible to normal frequency is connected between a neutral wire and ground so as to act as an alarm relay when abnormal conditions exist on the line.

1,062,084. **Electrically Operated Sash-Holder.** H. C. Desbecker, assignor to H. W. Block, New York, N. Y. An electromagnet is arranged to release a window-wedging cam.

1,062,085. **Window-Operating Apparatus.** H. C. Desbecker, assignor to H. W. Block. An electromagnetic release for a detent that keeps a spring from closing the window.

1,062,089 **Magneto Generator.** L. J. Flint, assignor to Grip Nut Co., Chicago, Ill. Ignition magneto with spark distributor and condenser on the armature shaft.

1,062,090. **Interrupter.** L. J. Flint, assignor to Grip Nut Co. For use with an ignition magneto.

1,062,096. **Controller for Electric Motors.** C. T. Henderson, assignor to Cutler-Hammer Mfg. Co., Milwaukee, Wis. Includes a special exciter for providing various voltages for electromagnetic resistance switches.

1,062,102. **Accounting Exchange.** W. F. Kemble, Rockaway Beach, and C. R. Underhill, Yonkers, N. Y., assignors of one-half to C. S. Champion. Has electrical means for selectively grouping pairs of debit and credit components.

1,062,111. **Electric Heater.** J. L. Nylander, Seattle, Wash. For a catheter.

1,062,117. **Portable Hand Electric Lamp.** A. C. Recker, assignor to Waterbury Mfg. Co., Waterbury, Conn. A reflector lamp with special handle.

1,062,126. **Trap.** F. Smith, Dallas, Ia. An electric rat trap.

1,062,136. **Thermostat.** T. H. Wurmb and R. Baumann, assignors to National Clock & Electric Mfg. Co., St. Louis, Mo. Includes a circuit-closer.

1,062,137. **Electric Fire Alarm.** H. Barditzky, Memphis, Tenn. A thermally expansible bar closes the circuit.

1,062,139. **Electric Lamp Socket.** R. B. Benjamin, assignor to Benjamin Electric Mfg. Co., Chicago, Ill. The cap has a lateral boss for securing to the end of the fixture arm.

1,062,156. **Ignition Magneto.** A. L. Heizer, assignor to Vesta Accumulator Co., Chicago, Ill. The armature has adjustable poles.

1,062,161. **Telephony.** I. Kitsee, Philadelphia, Pa. A method of duplexing the circuit by having the transmitter connected in series with the secondaries of induction coils, one having its primary in the live circuit and the other in a local shunt to the receiver.

1,062,168. **Arc-Light Electrode.** I. Ladoff, Cleveland, O., assignor of 31% to W. D. Edmonds. Has a core of copper in a covering of iron.

1,062,172. **Motor-Vehicle.** N. D. Levin, assignor to Jeffrey Mfg. Co., Columbus, O. An electric mining locomotive.

1,062,185. **Electric Switch.** L. J. Pierce, assignor to Window Glass Machine Co., Pittsburgh, Pa. The clips have ball-retaining seats, the balls engaging the blade.

1,062,194. **Type-Writing Machine.** J. Sokolov, assignor to Underwood Typewriter Co., New York, N. Y. Has a motor-driven carriage-return mechanism.

1,062,202. **Line Retriever.** C. W. Taylor, Los Angeles, Cal. Is motor-driven.

1,062,228. **Incandescent-Lamp Lock and Seal.** H. Davies and J. Cooke, West New York, N. J. Consists of a band fitting around the head of the socket and the base of the lamp bulb.

1,062,240. **Refillable Fuse-Plug.** F. H. Kaiser, Buffalo, N. Y. The fuse-wire ends are clamped between washers and the depressed central parts of the end caps of the cartridge.

1,062,281. **Forming-Machine for Tungsten Filaments.** J. W. Howell, assignor to General Electric Co. A number of filament receptacles are revolved in a circular path, a stream of gas being passed through all but one in succession.

1,062,282. **Automatic Clock-Winding Means.** M. Karsch, Los Angeles, Cal. Electrically operated.

1,062,292. **Audible Signal for Determining the Temperatures of Sea Water.** A. McNab, assignor to McNab Co.,

Bridgeport, Conn. A U-tube mercury thermometer has contract points connected to an electric annunciator and alarm.

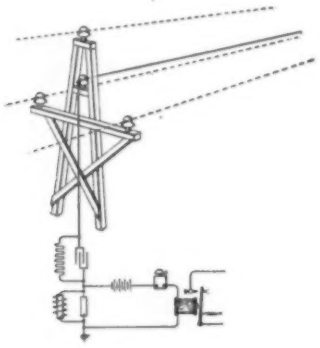
1,062,296. Insulated Rail-Joint. J. P. Noonan, Pittsburgh, Pa. Covers the design of the splice bars.

1,062,299. Electric Stove. C. A. Pfanstiehl, North Chicago, Ill. A disk stove with the central part separated from the annular edge by an air space, each portion having independent heating elements.

1,062,305. Incandescent Lamp. C. P. Steinmetz, assignor to General Electric Co. Mounted on the leading-in wires are arc-shaped electrodes, between which a discharge takes place when the vacuum deteriorates, thus setting free metal vapor with great affinity for gases and thereby again improving the vacuum.

1,062,344. Cooking and Domestic Utensil Heated by Electricity. J. Mann Prague, Austria-Hungary. A mug or cup with heating element in the bottom and part way up the side.

1,062,347. Method of Forming Cable. F. R. McBerty, assignor to Western Electric Co. Ribbon cable is woven



1,062,083.—Surge Alarm.

with two separate woof portions on a warp of parallel wires.

1,062,361. Generator of Intermittent Electric Currents. M. P. Ryder, White Plains, N. Y. Includes two electromagnet coils and a reciprocating armature.

1,062,362. Electric Furnace for the Continuous Manufacture of Glass. M. Sauvageon, Colombes, France. Has a melting and a refining chamber, each with separate heating means.

1,062,380. Regulator for Dynamo-Electric Machines. V. G. Apple, assignor to Apple Electric Co., Dayton, O. A vibrator is geared to the armature shaft.

1,062,381. Signaling System. C. E. Beach, assignor to G. O. Knapp, New York, N. Y. Includes a set of relays.

1,062,387. Measured-Service Telephone System. J. Erickson, assignor to Automatic Electric Co., Chicago, Ill. A pay station on an automatic system can call a party, but cannot communicate with him until coins are deposited.

1,062,388. Method of Changing the Composition of Iron and Steel. B. Ford, Philadelphia, Pa. Consists in electrically heating the object and decreasing the cross section of its ends.

1,062,408. Flaming-Arc Headlight. L. M. McBride, assignor to Arcturus Electric & Mfg. Co., Denver, Colo. Has converging electrodes with the arc at the focal point of the reflector.

1,062,414. Trolley. J. Pulit, New Haven, Conn. Has a guard arm on each side of the wheel.

1,062,423. Cloth-Guiding Machine. B. T. Steber, assignor to New Hartford Cotton Mfg. Co., New Hartford, N. Y. The driving motor's field is reversed when the follower is moved the other way.

1,062,431. Method of Purifying Carbon for Carbon Filaments. J. Billiter, Vienna, Austria-Hungary. The carbon is converted to colloidal form several times and then separated.

1,062,460. Electric-Lamp Holder. B. R. Hannan, Lawtey, Fla. An adjustable clamping bracket for mounting the lamp on a table edge.

1,062,516. Electric Fly-Killer. J. A. Tate, Monticello, Ark. Alternate positive and negative wires are placed parallel in a tent-like frame with a trough at each base.

1,062,522. Separation of Substances by the Wet Magnetic Process. G. Ullrich, assignor to Fried. Krupp Aktiengesellschaft, Grusonwerk, Magdeburg, Germany. The material is charged to a downwardly flowing stream in a magnetic field.

1,062,551. Electromechanical System for the Propulsion of Automobiles. H. Pieper, Liege, Belgium. Includes a storage battery and an engine and generator geared to each drive wheel, the generator being able to act as a motor.

1,062,555. Electric Fixture. E. L. Simons, Lansdowne, Pa., assignor of one-half to H. E. Johnson. A reflector, socket and switch are carried in an insulating shell.

1,062,139.—Fixture-Arm Socket.

1,062,559. Cushion for Diaphragms of Telephonic and Like Instruments. W. P. Stunz, assignor to G. R. Webb, Baltimore, Md. Consists of an elastic loop-formed annulus with undulatory branches.

1,062,571. Process of Electric Welding. C. R. Murray, L. R. Brink and W. K. Malmstrom, assignors to Barnhart Bros. & Spindler, Chicago, Ill. For welding the straight edge of a metal strip to a plane plate.

1,062,577. Telephone System. E. E. Kleinschmidt, assignor to General Railway Equipment Co. Relates to the selector mechanism for calling any station on a dispatching line.

Reissue.

13,564. Apparatus for the Production of High-Potential Electric Currents. D. G. McCaa, Lancaster, Pa. Original No. 1,047,545, dated Dec. 17, 1912. A D. C. source is connected through a pole-changer and condenser to the primary of a transformer.

Patents That Have Expired.

Following is a list of electrical patents (issued by the United States Patent Office) that expired May 26, 1913:

560,652. Electromagnetic Motor. F. M. Schmidt, Brooklyn, N. Y.

560,658. Controller for Electric Cars. E. A. Sperry, Cleveland, O.

560,667. Incandescent-Lamp Socket. H. C. Wirt, Schenectady, N. Y.

560,671. Electric Arc Lamp. T. E. Adams, Cleveland, O.

560,675. Signaling Apparatus. J. F. Barker, Springfield, Mass.

560,678. Electric Railway. H. Brandenburg, Chicago, Ill.

560,679. Apparatus for Producing Musical Sounds by Electricity. G. Breed, Philadelphia, Pa.

560,703. Electric Valve. C. L. Fortier, Chicago, Ill.

560,721. Electric Railway. E. H. Johnson, New York, and R. Lundell, Brooklyn, N. Y.

560,735. Alternating-Current Generator. W. S. Moody, Lynn, Mass.

560,737. Commutator Brush. W. H. Morgan, Alliance, O.

560,751. Electric Brake. W. B. Potter, Schenectady, N. Y.

560,757. Busy Signal for Telephone Lines. C. E. Scribner Chicago, Ill.

560,761. Telephone Circuit. J. S. Stone, Boston, Mass.

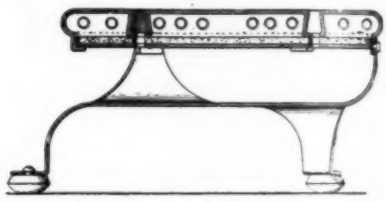
560,762. Telephone Circuit and Apparatus. J. S. Stone.

560,763. Automatic Heat-Regulating Device. J. V. Stout, Easton, Pa.

560,766. Controllable Switch-Box. J. Van Vleck, New York, N. Y.

560,772. Electrical Distributing System. R. R. Bowker, Brooklyn, N. Y.

560,792. Electric Arc Lamp. J. H. J. Haines, New York, N. Y.



1,062,299.—Double Disk Stove.

560,807. Conduit Electric Railway. W. Lobach, Chicago, Ill.

560,821. Electric Cutout. J. C. Reynolds, New York, N. Y.

560,841. Current-Collector for Electric Railways. A. N. Connett, Washington, D. C.

560,845. Telephone Exchange System. W. W. Dean, St. Louis, Mo.

560,852. Static Electrical Machine. C. M. Hollopeter, Fostoria, O.

560,861. Multiple Telephony. F. A. Pickernell, Newark, N. J.

560,894. Current-Collector for Electric Railways. A. N. Connett.

560,903. Electric Railway. W. H. Jordan, Brooklyn, N. Y.

560,917. Elevated Electric Railway. J. H. McGurty, Jersey City, N. J.

560,988. Electric Railway System. N. J. Halpine, U. S. Navy.

561,002. System of Electric Distribution. P. O. Keilholtz, Baltimore, Md.

561,046. Electrotherapeutic Apparatus for Treating Deafness. S. J. Collier, Chicago, Ill.

561,073. Lightning Arrester. W. Cooper, Schenectady, N. Y.

Reissues 11,542 and 11,543. Electric Locomotive. J. C. Henry, Denver, Colo.

Reissue 11,544. Combined Gas and Electric-Light Fixture. L. Stieringer, New York, N. Y.

Reissue 11,545. Automatic Device for Removing Resistance in Starting Electric Motors, Etc. G. H. Whittingham, Baltimore, Md.

Central-Station Service for Industrial Power Requirements

Complete Data Covering Electric Motor Applications in Actual Operation in 25 Leading Industries Using Central-Station Power.

THE DEVELOPMENT OF THE POWER LOAD is one of the most important divisions of central-station service. In no way can the load-factor of a central station be so materially improved, and the diversity so adequately placed under the control of the central station, as through the building up of a STEADY POWER LOAD from the requirements in industrial applications.

The COMMERCIAL DEPARTMENT of central stations, the power engineers, the consulting electrical engineers, the mechanical engineers, the millwrights and the superintendents of construction have always been eagerly on the lookout for information with respect to the motor drive and the characteristics of motor applications for adaptation to the machinery used in industries of every description. Up to a year or so ago there was a lamentable lack of definite information upon this important subject. The Commercial Section of the National Electric Light Association performed a remarkable service to the benefit of the electrical industry and the machine-tool industry in the preparation of its "Power Digest," and several of the leading manufacturers have also contributed notably to the information upon this subject.

With the first issue in January, 1912, the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN began the publication of a series of articles devoted to specific information relating to power applications in various industries. So diverse have been the applications described, and so useful and valuable the information published week by week, that this service has attracted widespread interest and commendation throughout every department of electrical service. The information published in these articles has been secured through direct visits and observations of our Editors at the plants described, and very careful studies of the power applications and the particular characteristics of the service. This information is correct in detail and the figures are susceptible of absolute substantiation. A conspicuous feature of these articles has been the "Data Sheets" which have accompanied each study of the power requirements of the different industries. They give to the power engineer a comprehensive knowledge of the application under discussion, so that he may visit and talk to the prospective customer and consumer of electrical energy in the terms of the man's own business. He is enabled to go to his prospect armed with reliable, complete information with regard to what the electric motor has done in other similar installations. For the central-station man it gives an opportunity to study methods of improving his load-factor, it acquaints him with the total connected horsepower of a given installation, the total number of motors installed, the average kilowatt-hours input per month, the kilowatt-hour consumption for each of the 12 months of the year, the type, speed and horsepower of each motor and the service to which it is adapted.

Many of the articles which have been published in the last 17 months are out of print. In deference to the numerous requests for data sheets, which the publishers have been unable to furnish, it has been decided to reproduce those which follow, as a contribution to the electrical industry, on the occasion of the 1913 Convention of the National Electric Light Association. The following subjects are treated in the section herewith:

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Boiler Shops—Data Sheet No. 2

Joseph Bromich Boiler Works, Topeka, Kans. Boiler manufacturing and repairs. Combination drive. Running hours per week, 54.

Total connected horsepower, 157.5. Number of motors installed, 18. Average kilowatt-hours per month, 1,675.

Kilowatt-hour consumption for 12 months: January, 840; February, 710; March, 430; April, 640; May, 2,410; June, 3,050; July, 2,220; August, 2,310; September, 1,120; October, 610; November, 2,700; December, 3,060.

Load-factor, 2 per cent; operating-time load-factor, 6.2 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is direct current.

No.	Horsepower.	Speed R. P. M.	Application.
1	3	1,120	Belted to blower.
1	8	1,120	Driving 6-inch angle-iron shear.
1	5	1,120	Driving small punch.
1	7.5	1,120	Geared to Hilles & Jones punch.
1	3	...	Geared to small bending roll.
1	5	...	Geared to small angle-iron roll.
1	10	...	Geared to bending roll 8-by-96-inch.
1	7.5	980	Belted to splitting shear.
1	7.5	1,120	Belted to Lennox bevel shear.
1	5	1,120	Driving hoist of riveting machine.
1	7.5	1,120	Belted to 8-inch pipe machine.
1	10	1,120	Belted to a line shaft driving two drills; two saws; one two-inch bolt machine; and one 15-inch lathe.
1	5	900	Belted to small re-punch.
1	1.5	1,200	Operating flue welder.
1	3	1,200	Belted to flue rattler.
1	16	...	Operating hoist.
1	8	...	Operating carriage of hoist.
1	35	900	Belted to air compressor.

Furnace and boiler plant making hot-air furnaces, steam and water boilers. The yearly output is 1,000 boilers.

Total connected horsepower, 60. Total number of motors installed, 3. Average kilowatt-hours per month, 969.

Kilowatt-hour consumption for 12 months: January, 542; February, 654; March, 657; April, 1,392; May, 923; June, 908; July, 1,011; August, 947; September, 1,115; October, 1,080; November, 1,414; December, 992.

Load-factor, 3 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts and 500 volts, direct current.

No.	Horsepower.	Speed R. P. M.	Application.
1	5	1,700 375	Squirrel-cage motor belted to a 22-foot shaft and 4 countershafts driving one Needham Company nipple lathe; one double emery wheel; one O. L. Packard's 16-inch engine lathe; and one double emery wheel, 12 by 2 inches.
1	5	1,500	Shunt-wound motor belted to a Baker Brothers No. 12, 24-inch drill press.
1	50	850	Squirrel-cage motor belted to 60 feet of shafting driving one Bury 10-by-10-inch air compressor, 75 pounds pressure; one Root's No. 3 rotary blower; one 4-foot by 28-inch tumbler; one Climax wire straightener; one double emery wheel; one Barnes 24-inch drill; one Wood Light & Company 14-inch engine lathe; one 16-inch drill; one jig saw; and one 28-by-2.5-inch grindstone.

Boiler plant specializes in boilers for small industrial locomotives and engines. Combination drive.

Total connected horsepower, 121. Total number of motors installed, 20. Average kilowatt-hours per month, 7,345.

Kilowatt-hour consumption for 12 months: January, 3,980; February, 5,320; March, 6,470; April, 7,210; May, 7,570; June, 7,890; July, 8,080; August, 8,450; September, 7,380; October, 7,260; November, 8,460; December, 9,280.

Load-factor, 11.1 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts and 110 volts, direct current.

No.	Horsepower.	Speed R. P. M.	Type.	Application.
1	10			
1	5		Series	Operating respectively the hoist, bridge and trolley drives of a Whiting Foundry Company 5-ton crane.
1	2.5			
2	5			
2	5		Series	Each operating respectively the hoist, bridge and trolley drives of two Whiting 2-ton cranes.
2	2			
2	7.5	1120	Squirrel-cage	Each geared to a Hilles & Jones No. 3 punch, flywheel 54-inch diameter.
1	12	Varying	Series	Geared to a bending roll, three rolls 8 inch by 96 in.
1	7.5	1120	Squirrel-cage	Geared to Wrangler bender.
1	7.5	1700	Squirrel-cage	Belted to 30-foot shaft driving one 16-inch drill; one 8-inch emery wheel; one pipe cutter; one 10-inch emery wheel.
1	5	1120	Squirrel-cage	Connected by chain to a Marshall & Haschart double bolt threader and cutter.
1	7.5	1120	Squirrel-cage	Geared to a Williams, White & Company No. 14½ double alligator shear.
1	2	1700	Squirrel-cage	Geared to a Bickford drill.
1	7.5	1200	Squirrel-cage	Geared to Hilles & Jones horizontal punch.
1	25	Varying	Series	Geared to a Bertsch & Company bending roll, three rolls each 12 by 144 inches.
1	10	840	Squirrel-cage	Belted to Sturtevant No. 9 blower.

Brewery Data—Sheet No. 1.

The term load-factor is used in these data in such a sense that a load-factor of 100 per cent represents the use for 24 hours every day of power corresponding to the rated capacity of the motors connected. An operating-time load-factor of 100 per cent represents the use of the rated capacity of the motors for the running hours per day specified for each installation.

Brewery, name withheld, having an average yearly output of 30,000 barrels of beer. In summer eight brews per week are made, and about six per week during the winter. There are 30 men employed, working 10 hours per day. Group and individual drive.

Total connected horsepower, 255; number of motors, 10; average kilowatt-hours per month, 18,080.

Kilowatt-hours per month, for twelve months: June, 28,630; July, 42,150; August, 33,240; September, 11,360; October, 19,600; November, 21,600; December, 8,230; January, 980; February, 950; March, 2,690; April, 24,960; May, 22,560.

Load-factor, 13 per cent; operating-time load-factor, 27.2 per cent.

The electrical energy consumption per 1,000 barrels brewed is 7,200 kilowatt-hours.

MOTOR INSTALLATION.

The following is a list of the motors installed, with their respective drives. All motors are of the induction type, squirrel-cage windings, except where indicated.

No.	Horse-power	Speed R. P. M.	Type	Application.
1	150	600	Slip-Ring	Belted to a 10-foot shaft (three hangers) and to the flywheel of a Linde ice machine; fiywheel, 120-inch diameter, rim 28-inch by 3.5-inch, 56 revolutions per minute. Cylinder 24-inch diameter by 30-inch stroke. Ammonia pressure, 150 to 180 pounds. Motor pulley 24-inch diameter.
1	75	600		Belted to a 20-foot shaft (four hangers) and to countershaft of a Linde ice machine. Flywheel, 180-inch diameter, rim 12-inch by 5.5-inch. Ammonia pressure, 150 to 180 pounds, 68 revolutions per minute. Cylinder 18-inch by 24-inch stroke.
1	1.5	1,700		Direct-connected to a Magnus beer pump.
1	2	1,120		Direct-connected to a Magnus beer pump.
1	5	1,700		Belted to a two-hanger shaft and a 20-foot shaft (four hangers), driving one Magnus keg washer and one Loco Magic pulp washer.
1	10	1,120		Belted to a 50-foot shaft (seven hangers), driving one 4,000-pound freight elevator, one Olsen & Tilgner malt-mill roll. 10-inch by 8-inch, and one 8-inch by 50-foot bucket elevator.
1	7.5	1,700		Belted to a two-hanger shaft driving a mash tub of 200-barrel capacity.
1	2	1,120		Belted to a 40-foot shaft (seven hangers), driving one bottle soaker, one Eick 16-bottle cleanser, one Crown Cork & Seal Company bottle-capper; flywheel, 16-inch diameter; rim, 4.5-inch by one-inch.
1	0.166	1,150	Single-phase	Geared to an Economic Machine Company labeling machine.
1	2	1,120		Belted to a Loew New Era pasteurizer.

The supply source is three-phase, 440-volts, 60 cycles.

E. Fleckenstein Brewing Company, Faribault, Minn. Individual drive. Running hours per week, 60.

Total connected horsepower, 46; total number of motors installed, 5; average kilowatt-hours, per month, 5,737; average kilowatt-hours, per month, per connected horsepower, 125.

Kilowatt-hours, per month, for six months: May, 4,720; June, 5,740; July, 7,233; August, 6,723; September, 5,730; October, 4,280.

Load-factor, 26.8 per cent; operating-time load-factor, 47.8 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. All motors are three-phase, 60 cycles, 220 volts.

No.	Horse-power	Speed R. P. M.	Application.
1	35		Belted direct to one 25-ton Linde ice machine, manufactured by the F W. Wolfe Company.
1	3	1,700	Direct-connected to pressure pump, used for circulating brine.
1	3	1,200	Belted direct to one 25-barrel pasteurizer.
1	3	1,800	Belted to one keg scrubber.
1	3	1,200	Belted direct to one deep-well pump.

Energy for this installation is supplied by the Consumers Power Company.

Cataract Consumers Brewery, Niagara Falls, N. Y. Individual drive.

Total connected horsepower, 165; total number of motors installed, 7; average kilowatt-hours per month, 30,728.

Kilowatt-hours, per month, for twelve months: January, 11,664; February, 4,727; March, 6,720; April, 11,554; May, 39,897; June, 50,678; July, 56,391; August, 57,364; September, 53,381; October, 43,862; November, 17,433; December, 11,073.

Load-factor, 34.2 per cent. Maximum for year, 106 kilowatts, in July.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is two-phase, 25 cycles, 440 volts.

No	Horse-power	Speed R. P. M.	Application.
1	75	750	Belted to ice machine.
1	30	750	Belted to grain conveyor.
1	20	750	Belted to grain conveyor.
1	10	750	Belted to washing machine.
1	10	750	Belted to bottling machine.
1	10	750	Belted to elevator.
1	10	750	Belted to grain conveyor.

Energy for this installation is supplied by the Niagara Falls Power Company.

Brick-Plant Data—Sheet No. 1.

The term load-factor is used in these data in such a sense that a load-factor of 100 per cent represents the use for 24 hours every day of power coresponding to the rated capacity of the motors connected. An operating-time load-factor of 100 per cent represents the use of the rated capacity of the motors for the running hours per day specified for each installation.

Enid Vitrified Brick & Tile Company, Enid, Okla. Manufactures brick and tile products. Group drive. Running hours per week, 60.

Total connected horsepower, 60. Number of motors installed, 1. Average kilowatt-hours per month, 8,399. Average kilowatt-hours per month, per connected horsepower, 139.

Kilowatt-hours per month for 12 months: January, 7,870; February, 9,530; March, 13,070; April, 11,850; May, 12,050; June, 10,150; July, 6,010; August, 5,350; September, 4,000; October, 9,500; November, 9,720; December, 1,680.

Load-factor, 25.7 per cent; operating-time load-factor,53.8 per cent.

The average electrical energy consumed per 1,000 bricks made is 11.2 kilowatt-hours.

MOTOR INSTALLATION.

The motor installed in this plant is a 60-cycle, three-phase, 2,080-volt machine.

No.	Horse-power.	Speed R. P. M.	Application.
1	60	720	Belted to a line shaft driving one nine-foot, Frost Manufacturing Company's dry pan; one Chisholm & Boyd mixer; one six-mold brick machine, capacity 30,000 bricks per 10 hours; and one 2,000-pound hoist elevator and conveyors.

This plant has been motor driven for three years without a day's loss due to motor power. Energy is supplied by the Enid Electric & Gas Company.

Keystone Clay Products Company, Greensburg, Pa. This is a six-kiln brick plant with a capacity of 60,000 bricks per day. The average daily output is 28,000 brick. Running hours per week, 60. (The pan and pug mills are operated approximately 48 hours per week.) Group drive.

Total connected horsepower, 215. Number of motors installed, 6. Average kilowatt-hours per month, 12,664.

Kilowatt-hours consumption for 12 months: January, 1,897; February, 1,593; March, 1,745; April, 2,156; May, 13,970; June, 1,782; July, 17,653; August, 19,689; September, 24,731; October, 27,917; November, 13,970; December, 24,870.

Load-factor, 11.8 per cent; operating-time load-factor, 22.6 per cent.

The average total electric energy consumption per 1,000 brick is 26.4 kilowatt-hours.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is two-phase, 60-cycles, 220-volts. The motors are of the squirrel-cage induction type.

No.	Horse-power.	Speed R. P. M.	Application.
1	40	840	Geared to a nine-foot dry pan and belted from extension shaft of dry pan to a 40-foot bucket conveyor.
1	40	840	Geared to a nine-foot dry pan and belted from extension shaft of dry pan to a 40-foot bucket conveyor and a 50-foot by 24-inch belt conveyor.
1	40	840	Geared to a No. 51 pug mill.
1	15	1,120	Belted through countershaft to a 140-inch blower. Speed 216 revolutions per minute. (Supplying draft for ovens.)
1	5	1,700	Belted to a 72-inch disk fan.
1	75	685	Geared to a No. 1 Giant brick auger (capacity 6,000 per hour). From the countershaft of brick auger is belted a 30-foot shaft (four hangers) which drives an 18-brick automatic cutter (three belt conveyors, 6-foot, 25-foot and 50-foot respectively), and a 10-foot bucket conveyor and repress.

All brick-making machines were supplied by the American Clay Machinery Company. Energy is supplied by the West Penn Electric Company.

Dry Pressed Brick Company, Sandpoint, Idaho. Manufactures pressed brick. Group drive. Running hours per week, 60.

Total connected horsepower, 117.5. Number of motors installed, 3. Average kilowatt-hours per month, 13,947. Average kilowatt-hours per month, per connected horsepower, 119.

Kilowatt-hours consumption for five months: April, 15,150; May, 18,280; June, 16,260; July, 15,780; August, 4,328.

Load-factor, 26 per cent; operating-time load-factor, 45.8 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60-cycles, 220-volts.

No.	Horse-power.	Speed R. P. M.	Application.
1	75	720	Belted to a line shaft driving one Andrews brick press, No. AA-110, capacity 1,800 bricks per hour; one Andrews brick press, No. AA-114, capacity 1,840 bricks per hour; one clay mixer and feeder; one Scott pulverizer; one 6 by 10-inch bucket conveyor, speed 160 feet per minute; one 6 by 10-inch bucket elevator, speed 500 feet per minute; one nine-foot clay mixer; and one 12-inch double-drum hoist, speed 200 feet per minute.
1	35	900	Belted direct to one nine-foot exhaust fan. Speed of fan, 300 revolutions per minute.
1	7.5	1,800	Belted to countershaft driving one coal conveyor. Speed of conveyor, 200 feet per minute; capacity, 10 tons per hour.

Energy for this installation is supplied by the Northern Idaho & Montana Power Company.

Candy Manufacturing Data—Sheet No. 2.

Plant "B." This plant, the name of which is withheld, manufactures carmels and taffy principally, although some coated candy is made on order. The company also makes its own packing boxes and decorative paper designs for confectionary stores. There are 75 persons employed. Running hours, per week, 60. Group drive.

Total connected horsepower, 57.5; total number of motors installed, 6; average kilowatt-hours per month, 2,440; load-factor, 7.7 per cent; operating-time load-factor, 16.3 per cent.

Kilowatt-hours, per month, for a period of one year: April, 2,045; May, 2,287; June, 2,852;; July, 2,533 August, 2,692; September, 2,916; October, 3,168; November, 2,419; December, 1,919; January, 2,114; February, 2,147; March, 2,191.

Motor Installation

The following is a list of the motors installed with their respective drives. The supply source is two-phase 220-volt, 60-cycles, and 220-volts, direct-current. The alternating-current motors are of the squirrel-cage induction type and the direct-current is a compound-wound machine.

No.	Horse-power.	Speed	Application.
1	10	1,200	Belted to a two-hanger line shaft and two 20-foot shafts (four hangers each) driving one Goulds No. 4 rotary pressure pump, pumping milk a distance of 32 feet; three chocolate beaters, 26 inches in diameter by 18 inches deep; one 10 by 36-inch chocolate beater with rotating wire paddle.
1	20	1,200	Belted to a two-hanger shaft and a 40-foot shaft (eight hangers), driving 10 Burkhart 25-gallon steam-jacketed cooking kettles; one Howes Eureka 8 by 30-inch cream beater; one Hildreth form-3 taffy puller, operating at 280 revolutions per minute; one 36 by 20-inch revolving coating pan, operating at 450 revolutions per minute; and one caramel cutter, having nine six-inch diameter steel disks on a 20-inch spindle, allowing any desired spacing.
1	5	1,800	Belted to a 20-foot shaft (three hangers), driving two V. Clad 24-inch sizing machines.
			PAPER-BOX DEPARTMENT.
1	7.5	1,200	Belted to a two-hanger shaft and a 60-foot shaft (seven hangers), driving one Knowlton No. 9 end stayer; one 10-inch rip saw; one American 35-inch paper slitter; one Robinson corner cutter; six-inch blades at right angles; one Seybold paper cutter, with 40-inch knife; one Knowlton 46-inch scoring machine; one Hobbs automatic, size 2, ending machine; one 12-inch stamping machine.
2	7.5	225	Compound-would motors, each direct-connected to operating mechanism of a 2,000-pound freight elevator.

Candy manufacturer, name withheld by request. Energy is supplied by The Milwaukee Electric Railway & Light Company, Milwaukee, Wis. Group drive. Running hours, per week, 60.

Total connected horsepower, 45; total number of motors installed, 6; average kilowatt-hours per month, 2,357; load-factor, 9.6 per cent; operating-time load-factor, 20.1 per cent.

Kilowatt-hours, per month, for twelve months; January, 932; February, 869; March, 978; April, 2,251; May, 3,412; June, 3,784; July, 4,513; August, 4,983; September, 2,814; October, 1,807; November, 1,318; December, 832.

Motor Installation.

The following is a list of the motors installed with their prospective drives. All motors are 220-volt, three-phase, 60-cycle machines.

No.	Horsepower	Application
2	2	Direct-connected to two blowers.
1	20	Belted direct to compressor.
1	7.5	Belted to a line shaft, driving one peanut roaster, one peanut crusher, one caramel cutter and one centrifugal pan.
1	10	Belted to line shaft, driving one starch buck, one marshmallow beater and two ice-cream stirrers.
2	3.5	Belted to line shaft, driving five melting kettles.

Summary of Data.

Plant No.	No. of Motors	Total Horsepower	Hours' Per Week	Load-Factor	Operating-Time Load-Factor	Average Kwh. Per Month
I	8	24	42	8.7	26.1	1,143
II	4	15	60	8.8	18.7	723
III	6	57.5	60	7.7	16.3	2,440
IV	5	19.5	60	8.9	18.6	947
V	6	45	60	9.6	20.1	2,357

Carriage and Wagon Works Data—Sheet No. 2.

Oklahoma Carriage Works, Oklahoma City, Okla. This plant manufactures carriages and wagons, operating 56 hours per week.

Total connected horsepower, 12.5. Total number of motors installed, 2. Average kilowatt-hours per month, 524. Average kilowatt-hours per month per connected horsepower, 42. Load-factor, 9 per cent.

Kilowatt-hour consumption for 12 months:

Month	Kilowatt-hours	Month	Kilowatt-hours	Month	Kilowatt-hours
January	590	May	524	September	570
February	486	June	638	October	446
March	472	July	690	November	516
April	478	August	500	December	398

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is 220 volts, direct current.

No.	Horse-power.	Speed R. P. M.	Application.
1	7.5	1,625	Belted to a line shaft driving one small drill press; one trip hammer; one two-spindle emery wheel; one small punch, and one forge blower.
1	5	1,650	Belted direct to one cut-off saw.

Energy is supplied by the Oklahoma Gas & Electric Company.

Carriage and wagon factory located in Chicago, manufacturing, principally, light delivery wagons.

Total connected horsepower, 57.5. Total number of motors installed, 22. Average kilowatt-hours per month, 3,295. Load-factor, 12 per cent.

Kilowatt-hour consumption for 12 months: January, 4,750; February, 2,440; March, 3,130; April, 3,220; May, 3,170; June, 3,100; July, 2,830; August, 2,750; September, 2,670; October, 4,700; November, 3,750; December, 3,030.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts.

No.	Horse-power.	Speed R. P. M.	Application.
1	7.5	800	Belted direct to elevator.
1	2	1,650	Belted to emery grinder.
2	2	1,100	Each belted direct to trip hammer.
4	0.5	500	Belted direct to small drill presses.
1	3.5	1,600	Belted to shafting driving punch and shears.
1	3.5	1,600	Belted direct to shaper.
1	2	1,650	Belted direct to cut-off swing saw.
1	2	1,600	Belted direct to tenoning machine.
1	2	1,500	Belted direct to sander.
1	3.5	1,600	Belted direct to planer.
1	2	1,650	Belted direct to boring machine.
1	1	740	Belted direct to thread cutter.
1	7.5	830	Belted direct to hydraulic press.
1	2	1,600	Belted direct to band saw.
1	3.5	1,650	Belted direct to rip saw.
1	3.5	1,650	Belted direct to jointer.
1	5	900	Belted direct to hub-boring machine.
1	1	1,000	Belted direct to tire-bending machine.

Energy is supplied by the Commonwealth Edison Company.

Wagon works, having an average output of 16 spring wagons and 50 wheelbarrows per month in addition to doing a general repair business. There are eight men employed working 10 hours per day.

Total connected horsepower, 30.5. Total number of motors installed, 15. Average kilowatt-hours per month, 496. Load-factor, 3 per cent; operating-time load-factor, 7 per cent.

Kilowatt-hour consumption for 12 months:

Month	Kilowatt-hours	Month	Kilowatt-hours	Month	Kilowatt-hours
January	495	May	476	September	438
February	682	June	457	October	439
March	584	July	415	November	601
April	476	August	383	December	505

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts.

No.	Horse-power.	Speed R. P. M.	Application.
1	2	1,700	Belted to a J. A. Fay & Egan jig mortiser with drill attachment.
1	1	1,700	Belted direct to 36-inch drum sander.
1	0.5	1,800	Belted to 12-inch double emery wheel.
1	1	1,700	Belted to L. Powers & Company No. 0 boring machine.
1	2	1,700	Belted to L. Powers & Company 20-inch jointer.
1	5	1,700	Belted to H. B. Smith 24-inch planer.
1	3	1,200	Belted to 48-inch band saw.
1	5	1,700	Belted to 18-inch self-feed rip saw.
1	1	1,700	Belted direct to 16-inch drill press.
1	1	1,700	Belted to 12-inch double emery wheel.
1	1	1,700	Belted to small shear and punch.
1	2	1,700	Belted to 4 by 7-inch roll-tire bender.
1	1	1,700	Belted to 26-inch drill press.
1	2	1,700	Belted to 800-pound Giant trip hammer.
1	3	1,700	Belted to No. 2 Buffalo forge blower.

Data Sheet for City Dairy.

Charles Gross, Philadelphia, Pa. 2,300 quarts daily.

Total connected horsepower, 10; total number of motors installed, 4; average kilowatt-hours per month, 953.

Kilowatt-hours per month for 1911 (motor load only): January, 44; February, 41; March, 78; April, 425; May, 1,195; June, 1,612; July, 2,416; August, 2,096; September, 1,638; October, 845; November, 872; December, 175.

MOTOR INSTALLATION.

One 7.5-horsepower, two-phase, induction motor, driving refrigerating machine by chain; one 2-horsepower, single-phase, 220-volt motor driving pumps for brine and milk through countershaft; two small 110-volt motors on lighting circuit, whose consumption is not included in above figures.

Load-factor for twelve months: 15.8 per cent.

Load-factor for four summer months: 32.1 per cent.

Load-factor on refrigerating motor alone for ten months, 18.2 per cent.

Average consumption, 13.6 watt-hours per quart of milk pasteurized and cooled.

Leo Bolzereit, Philadelphia, Pa. 4,000 quarts daily.

Motor used on refrigerating machine alone, capacity 8 tons.

Motor is two-phase, 60-cycle, 15-horsepower, 200-volt, squirrel-cage type, running at 1,120 revolutions per minute. Brine pump operated from countershaft. Under normal operation, input to motor is 17.9 kilowatts.

Kilowatt-hour consumption for three years is as follows:

	January	February	March	April	May	June	July	August	September	October	November	December
First year	313	30	14	1784	2077	2983	2990	2808	3004	2878	1729	691
Second year	0	0	3	957	1427	1828	2619	2128	2472	2077	1467	936
Third year	14	6	378	874	2092	2879	3000	2694	2963	2594	1948	770

Average kilowatt-hours per month, 1,595.

Load-factor for three years, 21.6, 16.1 and 20.6 per cent.

Load-factor for five-year period, 18.3 per cent.

Load-factor for six summer months, 34, 25.5 and 33 per cent.

Watt-hours per quart for three years, 14.5, 10.9 and 13.8.

United Sanitary Dairy Company, Austin, Ill. Combination drive.

Total connected horsepower, 48; total number of motors, 5; average kilowatt-hours per month, 5,753; average kilowatt-hours per month, per connected horsepower, 120.

Kilowatt-hour consumption for 1911; January, 2,710; February, 3,650; March, 3,510; April, 4,890; May, 7,060; June, 7,330; July, 7,810; August, 8,060; September, 7,340; October, 5,780; November, 4,780; December, 4,920.

Load-factor for twelve months, 22.2 per cent.

Load-factor for five summer months, 29.0 per cent.

MOTOR INSTALLATION.

Three-phase, 220-volt, induction motors are used, except for the smallest motor, which is single-phase.

Horsepower	Application
20	Belted to refrigerating machine and brine pump.
15	Belted to bottle-washing machine.
7.5	Drives churn, separator, clarifier and several small circulating pumps through line shaft.
5	Direct-connected to well pump.
0.5	Operates bottle brush.

William Kelly, Philadelphia, Pa. 9,000 quarts daily.

Total connected horsepower, 25.5; total number of motors, 4; average kilowatt-hours per month, 2,923.

Kilowatt-hour consumption for twenty-four months: January, 1,424; February, 1,731; March, 2,557; April, 3,027; May, 3,455; June, 4,564; July, 4,714; August, 5,068; September, 4,190; October, 2,802; November, 1,825; December, 1,288; January, 916; February, 868; March, 1,329; April, 2,121; May, 3,770; June, 4,505; July, 4,749; August, 4,661; September, 4,002; October, 3,340; November, 2,278; December, 1,972.

Load-factor for first year, 22.7 per cent; for second year, 21.4 per cent.

Load-factor for six months in summer, 31 per cent for each year.

Watt-hours per quart of milk, 11.1 for first year; 10.5 for second year.

MOTOR INSTALLATION.

15-horsepower, two-phase, squirrel-cage motor, for driving refrigerating machine and auxiliary pumps; 7.5-horsepower motor driving churn, air compressor and three circulating pumps through line shaft; two-horsepower motor driving well pump; one-horsepower motor driving bottle washer.

Name withheld. Connected horsepower, 15.

An eight-ton Barber refrigerating machine is run at 106 revolutions per minute. The brine pump is driven from the flywheel of the machine at 42 revolutions per minute. It has three cylinders, 3 by 4 inches, single-acting. An actual test under running conditions showed power input to motor to be 18 kilowatts. A 220-volt, two-phase, 15-horsepower motor, running at 720 revolutions per minute, is used.

Kilowatt-hour consumption for one year is as follows: January, 628; February, 450; March, 594; April, 1,521; May, 2,512; June, 3,108; July, 4,196; August, 3,593; September, 2,784; October, 1,951; November. 1,171; December, 360.

Average kilowatt-hours per month, 1,906.

Load-factor for twelve months, 25 per cent.

Load-factor for five summer months, 42 per cent.

Clothing Data—Sheet No. 1.

The term load-factor is used in these data in such a sense that a load-factor of 100 per cent represents the use for 24 hours every day of power corresponding to the rated capacity of the motors connected. An operating-time load-factor of 100 per cent represents the use of the rated capacity of the motors for the running hours per day specified for each installation.

Small clothing manufacturer, located in Wisconsin.

Total connected horsepower, 19.25. Number of motors installed, 6. Average kilowatt-hours per month, 880.

Kilowatt-hour consumption for 12 months:

Month.	Kilowatt-hours.	Month.	Kilowatt-hours.	Month.	Kilowatt-hours.
January	910	May	894	September	766
February	902	June	950	October	852
March	871	July	762	November	1,022
April	877	August	989	December	774

Load-factor, 8.5 per cent.

MOTOR INSTALLATION.

Following is a list of the motors with their respective drives. Supply source is 220 volts, direct current.

No.	Horse-power.	Speed R. P. M.	Application.
1	7.5	825	Belted direct to freight-elevator mechanism.
1	4	1,175	Belted direct to high-pressure fire pump.
1	1	1,200	Belted to small air compressor.
1	2.5	450	Belted to line shaft driving 17 factory sewing machines.
1	1.25	480	Belted to line shaft driving eight factory sewing machines.
1	3	...	Belted to line shaft driving a battery of 20 factory sewing machines.

Clothing plant manufacturing overalls, shirts, pants and duck clothing, having an average output of 4,100 dozen garments per month. A laundry is operated in conjunction with the clothing factory, which is supplied with high-pressure steam by a small vertical high-pressure boiler, consuming about 500 pounds of coal per week.

Total connected horsepower, 69.6. Number of motors installed, 21. Average kilowatt-hours per month, 1,912.

Kilowatt-hour consumption for 11 months: January, 3,530; February, 3,400; March, 3,620; April, 3,360; May, 1,200; June, 880; July 940; August, 190; October, 2,460; November, 730; December, 2,640.

The approximate electrical energy consumption per dozen garments manufactured is 0.46 kilowatt-hours.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. Load-factor, 5 per cent.

No.	Horse-power.	Speed R. P. M.	Application.
1	15	750	Direct-connected to elevator engine. This motor is a 500-volt compound-wound machine.
3	0.2	2,550	Each direct-connected to an Eastman garment-cutting machine.
1	2	490	Belted to shaft driving bench grinder and small engine lathe.
15	3.25	475	Direct-connected to shaft driving factory sewing machines. Each motor drives from 15 to 24 sewing machines; one motor having in addition to the sewing machines a National Laundry Machinery Company collar starcher; another motor drives, in addition to its quota of sewing machines, an American Laundry Machinery Company bosom ironer.
1	3.25	475	Direct-connected to shaft driving four button machines. Pulley on commutator end is belted to a one-kilowatt 110-volt generator for operating the Eastman cutting machines.

In addition to the motors there are installed six 8-pound electric irons and two 15-pound irons.

Clothing factory manufacturing men's shirts and also the pasteboard shipping boxes. There are 900 employees working 60 hours per week. The average output is 2,000 dozen finished shirts per week.

Total connected horsepower, 27. Number of motors installed, 10. Average kilowatt-hours per month, 1,687.

Kilowatt-hour consumption for 12 months: January, 1,573; February, 1,704; March, 1,796; April, 1,652; May, 1,831; June, 1,726; July, 1,334; August, 1,729; September, 1,679; October, 1,690; November, 1,813; December, 1,727.

Load-factor, 11.4 per cent; operating-time load-factor, 30.5 per cent.

The electrical energy consumption per 1,000 completed shirts is 16.3 kilowatt-hours.

MOTOR INSTALLATION.

The supply source is three-phase, 60 cycles, 220 volts. The motors are all of the squirrel-cage induction type.

No.	Horse-power.	Speed R. P. M.	Application.
1	4	1,120	Belted to a 40-foot shaft driving one J. T. Robinson scoring machine; one Holb automatic box ending machine; one Horace Inman corner cutter; one American Box Company slitter; one agitator for glue cooker; and one Knowlton & Beach corner stayer.
1	2	1,100	Belted to a 14-inch cut-off saw.
1	0.5	1,120	Belted to 9 feet of shafting and one countershaft driving one 10-inch emery wheel; and one sewing-machine test table.
1	1	1,120	Belted to a B. F. Sturtevant 20-inch blower.
1	5	1,120	Connected by Morse 1.5-inch chain to a 2,000-pound freight elevator.
1	1	1,120	Belted to 30-inch exhaust fan.
1	1.5	1,120	Belted to a 30-foot shaft (six hangers) driving one Adams Laundry Company ironer; one Troy Laundry Company dampener; and one agitator of "Textile" starch mixer.
1	4	1,120	Connected by Morse 1.5-inch chain to 70 feet of shafting (17 hangers) driving 12 Singer 63-1 sewing machines; seven Wilcox & Gibbs sewing machines; four Singer 71-22 sewing machines; five Singer 44-20 sewing machines; and four National buttonhole machines.
1	4	1,120	Connected by 1.5-inch Morse chain to 70 feet of shafting driving 34 Singer 44-20 labeling machines.
1	4	1,120	Connected by 1.5-inch Morse chain to 50 feet of shafting driving six Union special yoke machines; and 12 Singer 44-20 sewing machines.

Coal Mining Data—Sheet No. 1.

The term load-factor is used in these data in such a sense that a load-factor of 100 per cent represents the use of 24 hours every day of power corresponding to the rated capacity of the motors connected. An operating-time load-factor of 100 per cent represents the use of the rated capacity of the motors for the running hours per day specified for each installation.

Coal mine near Bluefield, W. Va., having an average production of 10,700 tons per month.

Total connected horsepower, 455. Total number of motors installed, 5. Average kilowatt-hours per month, 37,655.

Kilowatt-hour consumption for 9 months:

Month	Kilowatt-hours.	Tons Coal	Month	Kilowatt-Hours	Tons Coal	Month	Kilowatt-Hours	Tons Coal
April	26,900	11,571	July	37,800	11,585	October	57,700	12,102
May	29,000	9,262	August	43,800	12,258	November	43,200	9,407
June	29,500	8,742	September	41,400	11,050	December	29,600	10,752

Load-factor, 15 per cent.

The average energy consumption per ton of coal mined is 3.4 kilowatt-hours.

Motor Installation.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 440 volts.

No.	Horse-power.	Speed R. P. M.	Application.
1	300	900	Direct-connected to one 200-kilowatt 250-volt direct-current generator for supplying energy to the following: one 12-ton haulage locomotive; one 10-ton haulage locomotive; two four-ton gathering locomotives three 30-horsepower cutting machines; and one 15-ton Larry motor.
1	100	720	Slip-ring motor belted to shafting driving one automatic feeder; three sets of shaker screens; two jigs; one pump; two drag lines, 100 and 50 feet respectively; four elevators, 330 feet; one crusher; and one 60-foot picking table.
2	20	720	Each belted direct to a 16-foot Crawford & McCrimon fan.
1	15	900	Geared direct to deep-well pump.

Energy is supplied by the Appalachian Power Company.

Coal mine located near Bluefield, W. Va., having an average monthly production of 22,000 tons. This mine uses no cutting machine inasmuch as the coal formation is such that it is not necessary. There is still some steam haulage equipment that has not as yet been changed over.

Total connected horsepower, 325. Total number of motors installed, 3. Average kilowatt-hours per month, 17,300.

Kilowatt-hour consumption for 9 months:

Month.	Kilowatt-hours.	Month.	Kilowatt-hours.	Month.	Kilowatt-hours.
June	16,000	September	18,500	December	16,100
July	16,500	October	20,500	January	16,000
August	17,000	November	17,300	February	17,300

Load-factor, 9.7 per cent.

The average electrical energy consumption per ton of coal mined is 0.78 kilowatt-hours.

Motor Installation.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 440 volts.

No.	Horse-power	Speed R. P. M.	Application.
1	225	900	Direct-connected to a 150-kilowatt 250-volt direct-current generator supplying energy to the following: one 12-ton haulage locomotive; one 10-ton haulage locomotive; one five-ton gathering loocmotive; and one 15-horsepower motor, 900 revolutions per minute direct-connected to pump.
1	40	840	Belted direct to a 16-inch Cappell fan, speed 98 revolutions per minute.
1	40	570	Slip-ring motor, operating tipple.

Energy is supplied by the Appalachian Power Company.

Coal mine located near Bluefield, W. Va., havingan average monthly production of 20,000 tons. Some steam equipment is still temporarily retained.

Total connected horsepower, 225. One motor. Average kilowatt-hours per month, 10,926.

Kilowatt-hour consumption for five months: August, 10,550; September, 7,560; October, 10,390; November, 11,300; December, 14,833.

Load-factor, 8.9 per cent.

The average electrical energy consumption per ton of coal mined is 0.54 kilowatt-hours.

Motor Installation.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 440 volts.

No.	Horse-power	Speed R. P. M	Application.
1	225	900	Direct-connected to one 150-kilowatt 250-volt direct-current generator supplying energy for the following direct-current equipment: one 10-ton haulage locomotive; one six-ton gathering locomotive; one 15-horsepower motor direct-connected to 12-foot fan; one 15-horsepower motor belted direct to 14-foot fan; one short-wall mining machine; and one five-horsepower motor geared to pump.

Energy is supplied by the Appalachian Power Company.

Coal Mining Data—Sheet No. 2.

Coal mine located in Western Pennsylvania, having an average monthly output of 20,000 tons.

Total connected horsepower, 1,246. Number of motors, 21. Average kilowatt-hours per month, 517,556.

Kilowatt-hour consumption for six months:

Month.	Kilowatt-hours.	Tons Coal.	Month.	Kilowatt-hours.	Tons Coal.
February	596,890	20,330	May	452,970	13,178
March	771,580	27,631	June	415,980	19,833
April	393,410	9,626	July	474,510	21,662

Load-factor, 76 per cent.

The approximate total electric energy consumption per ton of coal mined is 3 kilowatt-hours.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is 600 volts direct current, and two-phase, 60-cycle, 220-volt, alternating current.

No.	Horse-power	Type	Application.
2	125	Series	Drives six-foot hoist drum through three sets of gears.
2	88	Compound	Belted to five-foot hoist drum.
1	200	690 R. P. M.	Alternating-current motor belted to exhaust fan, operating continuously.
1	175	Shunt	Geared to Worthington 10-inch turbine pump.
1	106	Shunt	Driving Aldrich 14 by 12-inch triplex pump.
1	60	Shunt	Belted to a six-wheel single-stage centrifugal pump.
1	60	Shunt	Belted to an 8 by 12-inch duplex pump.
1	4	Shunt	Belted to a Blackmer two-inch rotary pump.
1	5	Shunt	Belted a three-inch triplex pump.
1	10	Shunt	Belted to a Boyts & Porter four-inch duplex pump.
1	10	Shunt	Belted to a 10-foot line shaft driving one 16-inch drill press; and one 24-inch centrifugal fan for forge blower.
8	25	Shunt	Driving Jeffrey six-foot under-cut mining machines.

One 10-ton and one 8-ton locomotive, employed, are not included in the above.

Coal mine, having an average monthly output of approximately 2,000 tons. There are 22 miners working in two shifts of 9 hours each.

Total connected horsepower, 71. Number of motors, 4. Average kilowatt-hours per month, 1,653.

Kilowatt-hour consumption for 12 months: August, 1,025; September, 2,257; October, 1,737; November, 1,302; December, 1,046; January, 1,361; February, 2,043; March 1,979; April, 1,907; May 1,994; June, 1,567; July, 1,625.

Load-factor, 4.3 per cent.

The average electric energy consumption per ton of coal mined is 1.3 kilowatt-hours.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is 600 volts, direct current and two-phase, 60 cycles, 220 volts, alternating current.

No.	Horse-power	Type	Application.
2	25	Shunt	Driving Jeffery six-foot under-cut mining machines.
1	11	Series	Geared to 24-inch drum hoist hauling two two-ton cars up 200-foot incline, 20 per cent grade.
1	10		Alternating-current motor belted direct to 96-inch Stine ventilating fan.

Coal mine, having an average monthly output of 14,000 tons. There are 140 men employed working 8 hours per day. Hauling is done by mules, two 10-ton and two 6-ton electric locomotives.

Total connected horsepower, 245. Number of motors, 16. Average kilowatt-hours per month, 17,787.

Kilowatt-hour consumption for 9 months: November, 19,900; December, 19,880; January, 19,030; February, 10,202; March, 21,770; April, 10,370; May, 17,751; June, 18,962; July, 22,218.

Load-factor, 13 per cent; operating-time load-factor, 42 per cent.

The approximate electric energy consumption per ton of coal mined is 1.22 kilowatt-hours.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is 500 volts direct current.

No.	Horse-power	Speed R. P. M.	Winding	Application.
1	10	1,040	Shunt	Belted direct to a Stine suction fan, 5-foot diameter by one-foot face, running continuously at 300 revolutions.
2	20	1,040	Shunt	Each belted direct to a Stine suction fan, 6 foot diameter by one foot face, running continuously at 300 revolutions per minute.
1	20	1,040	Shunt	Direct-Connected to a Morris No. 3, four-inch centrifugal suction pump. Operates about two hours daily.
1	2.5	1,200	Shunt	Geared through two reduction gears to a 3 by 4-inch by 40-stroke Dean triplex pump.
3	10	1,200	Shunt	Each geared through two reduction gears to a 4 by 6-inch by 40-stroke Deming triplex pump.
4	25		Shunt	Each driving a Morgan-Gardner 6-foot undercut coal-cutting machine.
1	25		Shunt	Driving a Sullivan 6-foot under-cut coal-cutting machine.
1	7.5		Compound	Driving through reduction gears a small hoist for elevating material used in mine to tipple.
1	5	1,600	Shunt	Belted direct to flywheel of a small Ingersoll air compressor, Type No. 77, running at 300 revolutions per minute, furnishing air at 95 pounds pressure.
1	5.25	1,600	Shunt	Belted through countershaft to a 20-foot 4-hanger line shaft driving a 12-inch forge blower; 12-inch emery wheel; and a 16-inch drill press.

Cooper Shops—Data Sheet No. 1.

The term load-factor is used in these data in such a sense that a load-factor of 100 per cent represents the use for 24 hours every day of power corresponding to the rated capacity of the motors connected. An operating time load-factor of 100 per cent represents the use of the rated capacity of the motors for the running hours per day specified for each installation.

Cooper shop, name withheld. Combination drive. Running hours per week, 60.

Total connected horsepower, 47. Number of motors, 9. Average kilowatt-hours per month, 2,687.

Kilowatt-hour consumption for 10 months: November, 1,550; December, 2,020; January, 2,850; February, 2,920; March, 2,760; April, 2,720; May, 2,630; June, 2,870; July, 3,030; August, 3,520.

Load-factor, 10.4 per cent; operating-time load-factor, 21.5 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts:

No.	Horse-power.	Speed R. P. M.	Application.
1	3	1,700	Belted direct to a 16-inch swing cut-off saw.
1	7.5	1,700	Belted to a 5-foot shaft driving an Atlas self-feed glue jointer, 6,100 revolutions per minute.
1	15	1,700	Belted to a Borg & Beck Company self-feed stave machine, staves are 16 inches by 2⅜ inches by ⅞ inch.
1	7.5	1,120	Belted to a 50-foot shaft (six hangers) driving one J. S. Oram barrel-hooping machine; one lathe used for sandpapering tubs; one hoop bender, roll 8 inches by 12 inches; one hoop flaring machine; one hoop punch and riveter; and one 36-inch by 45-inch grindstone.
1	3	1,120	Belted to an Egan 36-inch by 0.25-inch band saw.
1	3	1,700	Belted to an 8-inch friction-feed cut-off saw.
1	5	1,120	Belted to a two-hanger shaft driving a heading cutter.
1	1	1,700	Belted to a two-hanger shaft driving a barrel conveyor.
1	2	1,700	Belted to the arbor of a 14-inch cup saw.

Barrel works, manufacturing barrels for cement and plaster, principally. Group drive. Running hours per week, 60.

Total connected horsepower, 30. One squirrel-cage induction motor is installed. Average kilowatt-hours per month, 1,254.

Kilowatt-hour consumption for 8 months: January, 800; February, 790; March, 1,420; April, 1,630; May, 1,390; June, 1,310; July, 1,270; August, 1,420.

Load-factor, 9 per cent; operating-time load-factor, 16 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts.

No.	Horse-power.	Speed R. P. M.	Application.
1	30	850	Belted to a 20-foot shaft (four hangers) driving one Sturtevant No. 5 blower, 1,000 revolutions per minute; one E. & B. Holmes barrel tresser driven by two belts. used for pressing steel hoops on barrels; one Holmes barrel raiser for drawing in ends of staves so that steel hoops can be loosely placed on barrels; one Holmes No. 33½ crozer used for cutting ridges in end of assembled staves to receive barrel head; one Ideal hooping-off and heading-up machine; one Buffalo No. 2 blower, attached to above machine; one Holmes punch press for riveting steel hoops, flywheel 46 inches diameter; one William Gladner hoop expander, 72 expansions per minute; and one 12-inch by 30-inch belt conveyor inclined at 30 degrees.

Cooper shop making white-oak whisky barrels. The plant has a monthly capacity of 4,500 barrels and an average monthly output of 3,500 barrels. Fifteen men are employed working nine hours per day

Total connected horsepower, 45. Total number of motors installed, 2. Average kilowatt-hours per month, 2,092.

Kilowatt-hour consumption for 12 months: August, 939; September, 1,072; October, 1,856; November, 2,596; December, 1,102; January, 3,102; February, 3,248; March, 2,598; April, 3,078; May, 2,742; June, 1,598; July, 1,176.

Load-factor, 8.6 per cent; operating-time load factor, 17.8 per cent.

Measured maximum demand, 35 horsepower.

The total electrical energy consumption per barrel manufactured is 0.57 kilowatt-hour.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts. Motors are of the squirrel-cage induction type

No.	Horse-power	Speed P. M.	Application.
1	40	850	Belt-connected to a 50-foot, five-hanger line shaft which drives one trussing machine, one single-end barrel windlass, one barrel lathe, one thin hoop driver, one double riveting machine (all five preceding machines of H. N. Strait Manufacturing Company), one hoop flaring machine, one 54-inch double-wheel stave jointer, one bung-boring machine, one 30-inch grindstone, and one double-end champhering off machine.
1	5	1,700	Belt connected to an A. M. Benson Company barrel-size stave bucking machine.

Cotton Mill Data—Sheet No. 1.

The term load-factor is used in these data in such a sense that a load-factor of 100 per cent represents the use for 24 hours every day of power corresponding to the rated capacity of the motors connected. An operating-time load-factor of 100 per cent represents the use of the rated capacity of the motors for the running hours per day specified for each installation.

Plant A. This is a 9,600-spindle, 240-loom mill located in North Carolina manufacturing a medium grade of gingham, exclusively. The average output is 16,800 pounds per week. Running hours per month, 520 (day and night shift).

Total connected horsepower, 551. Total number of motors installed, 27. Average kilowatt-hours per month, 69,158.

Kilowatt-hour consumption for 12 months:

Month	Kilowatt-hours	Month	Kilowatt-hours	Month	Kilowatt-hours
August	65,400	December	68,600	April	74,200
September	75,500	January	48,100	May	80,300
October	67,500	February	66,400	June	63,900
November	73,000	March	85,700	July	61,400

Load-factor, 23 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycle, 2,200 volts and 550 volts.

No.	Horse-power.	Speed R. P. M.	Application
			550-VOLT SERVICE.
2	3	1,800	Each belted direct to opener.
2	5	1,200	Each belted direct to breaker picker.
2	5	1,200	Each belted direct to an intermediate picker.
2	5	1,200	Each belted direct to finishing pickers.
1	5	1,200	Belted to line shaft driving machine-shop equipment.
1	5	1,200	Driving 4,000-pound-capacity elevator.
1	10	1,200	Belted to line shaft driving two 1,500-end warpers; and four 100-spindle spoolers.
1	15	1,200	Belted to line shaft driving beamers; brusher; and one baling press.
			2,200-VOLT SERVICE.
1	40	900	Belted to line shafting driving 30 cards.
1	60	900	Belted to line shafting driving 12 draw frames, five deliveries each; four slubbers, 84 spindles 12 by 6 inches; and six speeder frames, 164 spindles (8 by 4 inches) each.
4	25	1,800	Each belted to four 240-spindle filling spinning frames.
6	25	1,800	Each belted to four 240-spindle warp spinning frames. These 25-horse-power motors are of the four-frame-drive type.
1	50	900	Belted to line shaft driving 144 looms.
1	50	900	Belted to line shaft driving 96 looms.
1	30	1,200	Belted to line shaft in dye house driving extractor.

Energy is supplied by the Southern Power Company.

Majestic Cotton Mills, Belmont, N. C. This is an 18,240-spindle mill producing twisted yarns ranging in size from No. 70 to No. 120. Sea Island and Egyptian cotton is used. The average weekly output is 9,000 pounds. Running hours per week, 120.

Total connected horsepower, 516. Total number of motors installed, 27. Average kilowatt-hours per month, 99,641.

Kilowatt-hour consumption for 12 months:

Month	Kilowatt-hours	Month	Kilowatt-hours	Month	Kilowatt-hours
January	96,730	May	103,430	September	102,490
February	88,830	June	105,240	October	108,390
March	89,510	July	109,170	November	103,950
April	93,480	August	95,700	December	98,780

Load-factor, 35 per cent.

MOTOR INSTALLATION.

The folowing is a list of the motors instaled with their respective drives. The supply source is three-phase, 60 cycles, 2,200 volts.

No.	Horse-power.	Speed R. P. M.	Application
1	12	1,145	Belted direct to suction conveyor.
1	12	1,145	Belted to line shaft driving one single-beater opener picker; one intermediate picker; and one finishing picker.
1	20	1,150	Belted to line shaft driving 20 cards.
1	30	1,160	Belted to line shafting driving one ribbon lapper; one sliver lapper; 10 combers, eight heads each; four draw frames, 6 deliveries each; and two slubbers, 60 spindles each.
1	20	1,200	Belted to line shaft driving 10 fine frames, 200 spindles each.
20	20	1,150	Each motor belted direct to four spining frames, 228 spindles each.
1	12	1,145	Belted to line shafting driving eight spoolers, 100 spools each; four doubling spoolers, 100 spools each; six Universal winders, six ends each; two warpers; one Foster winder, 100 spindles; and eight 50-spindle reels.
1	10	1,200	Driving pumps.

Energy is supplied by the Southern Power Company.

Cotton Mill Data—Sheet No. 2.

Imperial Cotton Mills, Belmont, N. C. This mill manufactures twisted yarn for knitting mills, the average size being No. 72. The average output is 9,500 pounds. Running hours per week, 120.

Total connected horsepower, 500. 7 motors. Average kilowatt-hours per month, 168,433.

Kilowatt-hour consumption for 12 months:

Month	Kilowatt-hours	Month	Kilowatt-hours	Month	Kilowatt-hours
June	153,000	October	176,200	February	165,300
July	164,300	November	173,600	March	175,400
August	151,200	December	176,500	April	170,000
September	164,600	January	176,700	May	174,400

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 550 volts. Load-factor, 61 per cent.

No.	Horse-power.	Speed R. P. M.	Application.
1	50	850	Belted to line shafting driving one suction conveyor; one breaker and picker; two intermediate pickers; and two finishing pickers.
1	50	850	Belted to line shafting driving 24 cards; nine combers, of eight heads each; one sliver lapper; one ribbon lapper; and four draw frames, of four deliveries each.
1	50	850	Belted to line shaft driving two 60-spindle slubbers; four first intermediate spinning frames, 60 spindles each; four second intermediate frames, 142 spindles each; and 12 jack frames, 176 spindles each.
2	100	690	Each driving 24 frames of 216 spindles each.
1	50	900	Belted to line shafting driving eight wet twister frames, 216 spindles each; and five spooler frames of 120 spools each.
1	100	690	Belted to line shaft driving 18 twister frames, 216 spindles each; one spooler, 120 spindles; one Foster winder, 100 spindles; six Universal winders, six ends each; and eight reels, 40 spindles each.

Plant in South Carolina equipped with 10,240 spindles, manufacturing a fine grade of sheeting. The average weekly production is 13,000 pounds. Running hours per week, 60.

Total connected horsepower, 910. 27 motors. Average kilowatt-hours per month, 158,333.

Kilowatt-hour consumption for 12 months:

Month	Kilowatt-hours	Month	Kilowatt-hours	Month	Kilowatt-hours
June	158,800	October	163,100	February	180,400
July	119,800	November	181,100	March	190,400
August	129,900	December	177,000	April	167,600
September	161,300	January	173,100	May	177,500

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 550 volts. Load-factor, 31 per cent; operating-time load-factor, 66 per cent.

No.	Horse-power.	Speed R. P. M.	Application.
1	75	700	Belted to suction conveyor and condenser; three openers and breaker pickers; three intermediate pickers; and three finishing pickers.
1	100	700	Belted to line shafting driving 48 cards; and 16 draw frames, six deliveries each.
1	100	700	Belted to line shaft driving six slubbers, 60 spindles each; 10 intermediate slubbers, 90 spindles each; and 20 fine frames, 8 by 35, 160 spindles each.
10	20	1,700	Each driving four filling spining frames, 256 spindles each.
10	25	1,700	Each driving four warp spinning frames.
1	10	1,160	Belted to line shaft driving warp frames; six spoolers, 120 spindles each.
1	50	850	Belted to line shaft driving 160 36-inch looms.
1	100	700	Belted to line shaft driving 400 36-inch looms.
1	25	1,150	Belted to line shaft driving one suction fan; two slashers; one size kettle; two sewing machines; two calanders; two brushes; two folders; and one press.

Cotton Mill spinning No. 24 yarn. Average weekly output 18,000 pounds operating 120 hours per week.

Total connected horsepower, 140. 3 motors. Average kilowatt-hours per month, 24,702.

Kilowatt-hour consumption for 12 months:

Month	Kilowatt-hours	Month	Kilowatt-hours	Month	Kilowatt-hours
January	25,510	May	21,500	September	27,490
February	23,220	June	21,730	October	26,520
March	24,340	July	20,900	November	21,550
April	25,450	August	24,270	December	23,910

MOTOR INSTALLATION.

The following is a list of the motors installed wiwith their respective drives. The supply source is three-phase, 60 cycles, 2,200 volts. Load-factor, 32 per cent; operating-time load-factor, 34 per cent.

No.	Horse-power.	Speed R. P. M.	Application.
1	60	720	Belted to line shafting driving one opener breaker and picker; one intermediate picker; one finishing picker; 14 cards; four six-delivery draw frames; two slubbers, 40 spindles each; one intermediate frame, 180 spindles; one intermediate frame, 72 spindles; and five fine frames, 144 spindles each.
1	40	900	Belted to line shaft driving 12 216-spindle spinning frames.
1	40	900	Belted to line shaft driving 10 spinning frames, 216 spindles each; four reels, 50 spindles each; and two Foster winders, 100 spools each.

Cotton-Seed Oil Mill Data.

The term load-factor is used in these data in such a sense that a load-factor of 100 per cent represents the use for 24 hours every day of power corresponding to the rated capacity of the motors connected. An operating-time load-factor of 100 per cent represents the use of the rated capacity of the motors for the running hours per day specified for each installation.

Oil mill located in North Carolina. During the past year this mill ginned 1,686 bales of cotton and crushed 3,665 tons of seed, which represents an average season's work. The capacity of the mill is 30 tons of seed per 24 hours, and of the gin 35, 500-pound bales per 10 hours.

Total connected horsepower, 185. Two motors. Average kilowatt-hours per month, 15,612.

Kilowatt-hour consumption for 12 months: June, 140; July, 190; August, 770; September, 3,830; October, 44,330; November, 44,280; December, 37,880; January, 41,530; February, 11,160; March, 1,750; April, 1,000; May, 490.

Load-factor, 15 per cent; operating-time load-factor, 32 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. Motors 2,200 volts, three-phase, 60 cycles.

No.	Horse-power.	Speed R. P. M.	Application.
1	125	570	Belted to line shafting driving one seed-cleaning machine; one reel; one suction fan; 150 feet of six-inch screw conveyor; 5 linters; one huller; one separator; one set 30-inch crushing rolls; three cookers; one cake former; one pump; one 13.5-inch cake mill; one cake breaker; and one bolting reel.
1	160	700	Belted to a line shaft driving three 70-saw gins, 10-inch saws; one bale press; and one suction fan.

Energy is supplied by the Southern Power Company.

Farmers' Oil Mill, Newberry, S. C. This mill, in conjunction with a cotton gin, operates 12 hours per day.

Total connected horsepower, 200. Three motors. Average kilowatt-hours per month, 15,612.

Kilowatt-hour consumption for 12 months: June, 140; July, 190; August, 770; September, 3,830; October, 44,330; November, 44,280; December, 37,880; January, 41,530; February, 11,160; March, 1,750; April, 1,000; May, 490.

Load-factor, 14 per cent; operating-time load-factor, 25 per cent.

MOTOR INSTALLATION.

The following is the list of motors with their respective drives. Motors 500 volts, three-phase, 60 cycles.

No.	Horse-power.	Speed R. P. M.	Application.
1	85	855	Belted to a line shaft driving six 70-saw cotton gins, capacity 70 bales per 12-hour day; one baling press; and one 40-inch fan.
1	40	1,720	Belted to a line shaft driving one Foos No. 14 40-ton attrition mill; one cake cracker; and 100 feet of 6-inch conveyor.
1	75	650	Belted to line shafting driving 8 linters; 2 hullers; 3 double shakers; 2 hull beaters; one set 24-inch rolls; 8 6-inch bucket elevators, 150 feet; two cookers; one 40-ton seed cleaner; and one Tompkins reel. Capacity of mill, 36 tons per 24 hours.

Energy is supplied by the Southern Power Company.

Oil mill, capacity 24 tons of seed per 24 hours.

Total connected horsepower, 195. Three motors. Average kilowatt-hours per month, 18,870.

Kilowatt-hour consumption for 10 months: August, 12,600; September, 2,600; October, 38,400; November, 34,300; December, 30,900; January, 40,200; February, 28,500; March, 400; April, 700; May, 100.

Load-factor, 18 per cent.

MOTOR INSTALLATION.

Following is a list of motors with their respective drives. Motors 2,200 volts, three-phase, 60 cycles.

No.	Horse-power.	Speed R. P. M.	Application.
1	35	800	Belted to a No. 13½ 25-ton cake mill.
1	85	570	Belted to line shafting driving one set of 24-inch roll; 3 cookers; 4 linters; one 60-ton huller, 2 reels; 2 shakers; one cleaning machine; one linter press; six elevators; and 300 feet of conveyor.
1	75	570	Belted to a line shaft driving three 70-saw gins; one bale press; and one 40-inch fan.

Energy is supplied by the Southern Power Company.

Creamery Data—Sheet No. 3.

Creamery, located in Wisconsin. Combination drive. Running hours per week, 168.

Total connected horsepower, 77.5. Total number of motors installed, 6. Average kilowatt-hours per month, 16,263. Average kilowatt-hours per month per horsepower connected, 210.

Kilowatt-hour consumption for 10 months: January, 13,020; February, 9,810; March, 8,000; April, 11,690; May, 18,590; June, 20,480; July, 20,790; August, 25,610; September, 17,300; October, 17,340.

Load-factor, 38.6 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives The supply source is three-phase, 60 cycles, 220 volts.

No.	Horse-power.	Speed R. P. M.	Application.
1	50	900	Belted to line shaft driving one 25-ton Harris ice machine; one freight elevator; and two 4 by 5 circulating pumps.
1	2	1,200	Belted direct to one brine circulating pump.
2	10	1,200	Belted to line shaft, each driving two churns; five ripeners; one pasteurizer; and one tester.
1	5	1,800	Belted direct to one casein grinder.
1	0.5	1,800	Belted direct to one triplex oil pump for furnishing oil for boiler fuel.

Marinette Produce Company, Marinette, Wis. This plant has an average output of 4,000 pounds of butter per week. Two men are employed.

Total connected horsepower, 5. One squirrel-cage induction motor is installed. Average kilowatt-hours per month, 76.

Kilowatt-hour consumption for 12 months:

Month.	Kilowatt-hours.	Month.	Kilowatt-hours.	Month.	Kilowatt-hours.
July	152	November	53	March	46
August	134	December	28	April	30
September	131	January	20	May	61
October	83	February	34	June	125

Load-factor, 2.7 per cent.

MOTOR INSTALLATION.

The following are the machines connected to the motor. The supply source is three-phase, 60 cycles, 440 volts

No.	Horse-power.	Speed R. P. M.	Application.
1	5	1,800	Belted to a line shaft driving one 800-pound combinted churn and butter worker; one 400-pound cream ripener; one small ice-cream freezer; and one ice crusher.

Energy is supplied by the Menominee & Marinette Light & Traction Company

Central Creamery, Ferndale, Cal. Combination drive. Running hours per week, 168.

Total connected horsepower, 98.5. Total number of motors installed, 13. Average kilowatt-hours per month, 17,088. Average kilowatt-hours per month per connected horsepower, 173.48.

Kilowatt-hour consumption for 5 months: June, 17,570; July, 17,440; August, 17,490; September, 17,340; October, 15,600.

Load-factor, 32 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts.

No.	Horse-power.	Speed R. P. M.	Application.
1	15	1,200	Belted to line shaft driving one 10-ton Harris ice machine; and one brine circulating pump.
1	10	1,200	Belted to line shaft driving seven ripeners; two churns; and one cooler.
1	15	1,200	Belted to line shaft driving two separators; one cooler; one pasteurizer; two milk hoists; four ripeners; one 4 by 5 high-pressure triplex pump; and one 5 by 7 circulating pump.
1	5	1,200	Belted to line shaft driving one 5 by 9 high-pressure triplex pump; one heater; and one one-inch centrifugal pump.
1	15	200	Belted to line shaft driving one freight elevator; one drying blower; one milk shaker; and one ventilating fan.
1	1	1,800	Belted direct to one 4 by 5 brine circulating pump.
1	3	1,800	Belted to line shaft driving two separators; one pasteurizer; and one milk hoist.
1	7.5	1,200	Belted to line shaft driving one 4 by 5-inch high-pressure triplex pump; one brine circulating pump; two ripeners; and one can filler.
1	5	1,800	Belted direct to one hot-air blower.
1	7.5	1,200	Belted direct to one casein grinder.
1	7.5	1,800	Belted to line shaft driving one casein hoist; one casein grinder; and one hot-air blower.
1	2	1,800	Belted to line shaft driving one can sealer; and one butter tamper.
2	1	1,800	Each belted direct to a triplex water pump.

Energy is supplied by the Ferndale Electric Light Company.

Flour and Grist-Mill Data—Sheet No. 1.

The term load-factor is used in these data in such a sense that a load-factor of 100 per cent represents the use for 24 hours every day of power corresponding to the rated capacity of the motors connected. An operating-time load-factor of 100 per cent represents the use of the rated capacity of the motors for the running hours per day specified for each installation.

The Albany Mill & Elevator Company, Albany, Ore., millers of high grade wheat flour. Group drive. Running hours per week, 54.

Total connected horsepower, 50; total number of motors installed, 2; average kilowatt-hours per month, 5,785; average kilowatt-hours per month per connected horsepower, 115; load-factor, 21.4 per cent; operating time load-factor, 41 per cent.

Kilowatt-hours per month for six months (1911): January, 6,850; February, 4,080; March, 5,410; October, 6,500; November, 6,500; December, 5,370.

MOTOR INSTALLATION

The following is a list of the motors installed in this plant, with their respective drives:

No.	Horse-power	Speed	Application
1	30	1,200	Belted to a line shaft driving one milling separator, three sets of 7 by 20-inch rolls, one set of 9 by 18-inch rolls, one bran packer, one six-inch scalper, two packers, one purifier, one size 0 centrifugal reel, one size 1 centrifugal reel, one size 1 scourer, one size 0 sifter, and one dust collector.
1	20	1,200	Belted to a line shaft driving two receiving separators and one roll for chapping.

All of the above machinery was manufactured by Barnard & Leas Company. The capacity of this mill is 60 barrels of flour per day. The average output for six months was 450 barrels per month. The average kilowatt-hours consumed per barrel of flour was 13. Sixty-cycle, three-phase energy, at a potential of 220 volts is supplied by the Oregon Power Company.

Michigan Milling Company, Ann Arbor, Mich., millers of "King Roller" and "White Loaf" flour. Group drive. Running hours per week, 144. Usually for about three months each year the running hours per week are 60.

Total connected horsepower, 105; total number of motors installed, 2; average kilowatt-hours per month, 27,857; load-factor, 48 per cent.

The capacity of this mill is 240 barrels per 24-hour day. The current consumption per barrel of output, tested for a continuous period of three months, was 10.5 kilowatt-hours.

Kilowatt-hours consumption for 12 months: January, 30,180; February, 30,750; March, 31,860; April, 20,970; May, 19,830; June, 23,990; July, 20,229; August, 24,310; September, 26,730; October, 43,690; November, 36,690; December, 25,060.

MOTOR INSTALLATION

The following is a list of the motors installed, with their respective drives.

No.	Horse-power	Speed	Application
1	75	900	2,300-volt, three-phase, 60-cycle induction motor belted to shafting driving four grain cleaners, nine double-stand roller mills, 26 stands of three-inch-bucket elevators, four purifiers, three sifters, five dust collectors, four reels, two dusters, one scroll machine, five flour packers and one feed packer.
1	30	1,200	220-volt, three-phase, 60-cycle motor driving one feed roll, one corn sheller, one separator and four stands of elevators.

The Michigan Milling Company also operates a 170-barrel flour mill in which the same motor equipment is installed. Energy for both installations is supplied by the Eastern Michigan Edison Company.

Plant "A." Feed mill located in Western Pennsylvania. Energy is supplied by the West Penn Electric Company. This mill handles approximately 8,000 bushels of grain per year. Group drive. Running hours per week, 54.

Total connected horsepower, 20. One motor is installed having a maximum demand of 25 horsepower. Average kilowatt-hours per month, 149; load-factor, 1.4 per cent; operating time load-factor, 3.2 per cent.

Kilowatt-hours per month for 12 months: January, 143; February, 130; March, 176; April, 186; May, 136; June, 177; July, 112; August, 174; September, 143; October, 157; November, 125; December, 135.

The approximate total electrical energy consumption per 100 bushels of grain is 1.8 kilowatt-hours.

MOTOR INSTALLATION

The following is a list of the machines in this plant. The motor is a 500-volt compound-wound direct-current machine.

No.	Horse-power	Speed	Application
1	20	600	Belted to a 19-foot, three-hanger shaft and two three-foot, two-hanger shafts driving one 3,000-pound Crane freight elevator, one Nordyke & Marmon hexagonal scalper, one 24-inch grindstone, one 10-bushel feed mixer, one 12-inch-roll grain chopper and one 25-foot bucket conveyor having a capacity of 500 bushels per hour.

Flour and Grist-Mill Data—Sheet No. 2.

Faulk Brothers Company, East Liverpool, O. This plant makes wheat and buckwheat flour and grinds feed. Group drive. Running hours per week, 60. The plant produces 25 barrels of flour a day and grinds approximately four tons of feed. Five men are employed.

Total connected horsepower, 83; total number of motors installed, 5; average kilowatt-hours per month, 5,990; load-factor, 13 per cent; operating-time load-factor, 26 per cent.

The kilowatt-hour consumption for a period of three months is as follows: November, 5,140; December, 6,270; January, 6,560.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. All motors are of the slip-ring type, two-phase, 60-cycles, 220 volts.

No.	Horse-power.	Speed.	Application.
1	30	1,150	Belted to a 31-foot, eight-hanger line shaft driving one 9-by-18-inch double-stand feed mill, one Monarch, size 5, No. 20 cracked-corn mill, one G. T. Smith No. 3 scalper, one Monarch 48-by-36-inch corn sieve, one Monarch No. 698 grain separator, and three seven-inch-bucket elevators.
1	30	1,150	Belted to a 64-foot, 16-hanger line shaft driving four Monarch 9-by-18-inch double-stand flour mills, two Monarch flour packers, packing one-eighth-barrel bags, one American No. 4V blower, operating at 2,080 revolutions per minute, for dust-collecting system, one Monarch, size 0, bran duster, one Whitmore, size 2, middlings purifier, one Monarch, style E, sieve bolter, one Monarch, size 3, centrifugal flour reel, operating at 200 revolutions per minute, one 24-inch by six-foot flour reel, operating at 200 revolutions per minute, one Monarch, size 1, scourer, operating at 690 revolutions per minute, 14 six-inch-bucket elevators and two eight-inch-bucket elevators.
1	15	1,150	Belted to a 15-foot, six-hanger line shaft and countershaft driving one 12-inch, 96-foot screw conveyor, operating at 70 revolutions per minute, one Monarch, size 4, grain cleaner operating at 580 revolutions per minute, one Monarch, size 3, grain cleaner operating at 600 revolutions per minute, and four eight-inch-bucket elevators.
1	8	1,080	Direct-connected to an Otis 2,000-pound freight elevator.
1	3	1,700	Squirrel-cage motor belted through a six-foot shaft to a hay elevator.

Energy for this installation is supplied by the East Liverpool Traction & Light Company.

Davidson Mill & Elevator Company, Muskogee, Okla. Does a general milling business. Group drive. Running hours per week, 24.

Total connected horsepower, 125; total number of motors installed, 2; average kilowatt-hours per month, 3,394; average kilowatt-hours per month per horsepower connected, 27; load-factor, 5.1 per cent; operating-time load-factor, 26 per cent.

Kilowatt-hours per month for 12 months: January, 4,784; February, 3,480; March, 4,020; April, 3,960; May, 4,680; June, 2,130; July, 3,490; August, 2,470; September, 2,640; October, 3,620; November, 2,626; December, 2,828.

MOTOR INSTALLATION.

The following is a list of the motors installed, with their respective drives. Both motors are three-phase, 60-cycle machines, operating at 220 volts.

No.	Horse-power.	Speed.	Application.
1	50	1,800	Belted to line shaft driving two double stands of 9-by-24-inch rolls, one bran packer, and four six-inch-bucket elevators.
1	75	1,800	Belted to a line shaft driving one corn sheller, having a capacity of 1,000 bushels per hour, one 12-inch-bucket elevator, one four-inch-bucket elevator, one cleaner and one chop mill having a capacity of 1,000 bushels per hour.

The capacity of the rolls is 400 barrels per 24-hour day. Both of the motors in this installation are too large for the present equipment. Energy is supplied by the Muskogee Gas & Electric Company.

Johnson & Marquis, Enid, Okla. Grain dealers. Group drive. Running hours per week, 30.

Total connected horsepower, 25; total number of motors installed, 2; average kilowatt-hours per month, 758; load-factor, 5.6 per cent.

Kilowatt-hour consumption for 11 months: January, 960; February, 1,130: March, 640; April, 420; May, 520; June, 190; July, 1,357; August, 670; September, 1,070; October, 670; November, 720.

MOTOR INSTALLATION.

Motors in this installation are three-phase, 60-cycle, 220-volt machines.

No.	Horse-power.	Speed.	Application.
1	10	1,200	Direct-connected to No. 5 oat clipper, capacity 225 bushels per hour.
1	15	1,200	Belted to line shaft driving No. 5 separator; No. 5 duster; one 9-by-18-inch burr mill, capacity 150 bushels per hour; three elevators; one corn separator; one corn sheller, capacity 350 bushels per hour; and one car loader.

Furniture-Factory Data—Sheet No. 1.

The Rockford Superior Furniture Company, Rockford, Ill., manufacturers of high-grade china closets, buffets, etc. Combination drive. Running hours per week, 60.

Total connected horsepower, 199.5; total number of motors installed, 21; average kilowatt-hours per month, 13,645.

Kilowatt-hours per month, for twelve months (1910-11): November, 15,570; December, 12,750; January, 13,080; February, 13,680; March, 14,710; April, 14,440; May, 11,260; June, 6,680 (half month); July, 11,630; August, 17,390; September, 12,470; October, 13,116.

MOTOR INSTALLATION.

The following includes a list of the motors installed, with their respective drives. All motors are three-phase sixty-cycle induction motors operating at 220 volts.

No.	Horse-power	Speed R. P. M.	Application.
1	40	680	Direct-connected to a double 48-inch blower.
2	10	1,100	Geared to two two-ton elevators.
1	1	1,700	Belted to glue clamp.
1	7.5	1,700	Driving a 30-inch blower.
1	15	1,700	Belted to four-spindle sticker.
1	5	1,700	Belted to 16-inch rip saw.
1	3	1,700	Belted to cut-off saw.
1	15	1,700	Belted to four-roll sander.
1	15	1,700	Driving 36-inch planer and 36-inch jointer.
1	10	1,700	Driving line shaft to which are belted two resaws and one two-spindle shaper.
1	5	1,700	Belted to covering machine.
1	10	1,700	Belted to automatic double cut-off saw.
1	5	1,700	Driving cut-off saw and rip saw.
1	3	1,700	Belted to 16-inch cut-off saw.
1	5	1,700	Belted to 16-inch rip saw.
1	5	1,700	Driving line shaft to which are belted a belt sander, a spindle sander and a roll sander.
1	5	1,700	Belted to line shaft, driving one dovetailing machine, and one small tenoner.
1	10	1,700	Belted to line shaft, driving one 28-inch jointer with automatic feed and one continuous jointer.
1	5	1,700	Driving one 36-inch band saw and one jig saw.
1	5	1,700	Belted to tenoning machine.

This plant is one of the largest furniture factories in Rockford, and has been the means of securing other business in the town. The Rockford Electric Company has advocated conservation of refuse in this plant rather than the disposal of it. Sawdust is used for generating steam for dry-kiln work during the summer months, the strips and other refuse being stored in the coal bin to be used in winter when steam must be kept on the building and dry kiln, 24 hours a day. As a result of this policy no coal was used until December.

The Henderson-Ames Company, Kalamazoo, Mich., manufacturers of lodge furniture. Combination drive. Running hours per week, 54. Plant employs fourteen men.

Total connected horsepower, 31.5; total number of motors installed, 7; average kilowatt-hours per month, 632.

Kilowatt-hour consumption for twelve months (1910-11): December, 880; January, 970; February, 980; March, 700; April, 740; May, 480; June, 470; July, 290; August, 510; September, 470; October, 510; November, 580.

MOTOR INSTALLATION.

The following includes a list of the motors installed, with their respective drives. All motors are sixty-cycle, three-phase induction motors, operating at 440 volts at a speed of 1,800 revolutions per minute.

No.	Horsepower	Application.
1	3	Belted to Oliver dimension saw.
1	5	Belted to line shaft, driving one 12-inch American belt sander, one Beach jig saw, one Porter turning lathe, one Fay shaper and one 36-inch band saw.
1	7.5	Belted to a 30-inch blower.
1	5	Belted to 30-inch planer.
1	3	Belted to line shaft, driving No. 2½ American horizontal boring machine and one Dodd swing cut-off saw.
1	3	Driving through belts a Jones No. 16 rip saw and a Fay & Egan twelve-inch jointer.
1	5	Belted to two Singer sewing machines.

Energy for this installation is furnished by the Commonwealth Power Company. Refuse from this plant is sufficient to necessitate purchasing only a small amount of coal.

The Rockford Cedar Furniture Company, Rockford, Ill., manufacturers of cedar clothes chests and miscellaneous cedar furniture. Combination drive. Running hours per week, 60.

Total connected horsepower, 55; total number of motors installed, 8. This installation has only been in service since September, 1911, and the following kilowatt-hour readings are all that are available: September, 1,200; October, 1,800; November, 2,000.

MOTOR INSTALLATION.

The following includes a list of the motors installed, with their respective drives. All motors are three-phase, sixty-cycle induction motors, operating at 220 volts.

No.	Horse-power	Speed R. P. M.	Application.
1	15	900	Direct-connected to four-roll sander.
1	10	900	Direct-connected to 36-inch planer.
1	5	1,700	Belted to double-spindle shaper.
1	5	1,700	Belted to 24-inch blower.
1	5	1,700	Belted to tenoning machine and 36-inch band saw.
1	5	1,700	Belted to small sticker.
1	5	1,700	Belted to 30-inch jointer.
1	5	1,700	Driving swing saw and rip saw.

Furniture-Factory Data—Sheet No. 2.

The Lewis Geer Manufacturing Company, Ypsilanti, Mich. Manufactures swing and lawn seats. Individual drive. Running hours per week, 48.

Total connected horsepower, 36.5; total number of motors installed, 7; average kilowatt-hours per month, 1,435; average kilowatt-hours per month per horsepower connected, 39.4.

Kilowatt-hour consumption for twelve months (1911): January, 1,525; February, 1,590; March, 2,280; April, 2,490; May, 2,230; June, 2,020; July, 1,510; August, 710; September, 1,125; October, 850; November, 480; December, 450.

MOTOR INSTALLATION.

The following includes a list of the motors installed, with their respective drives. All motors operate at 1,800 revolutions per minute and are of the three-phase, sixty-cycle, 220-volt type.

No.	Horsepower.	Application.
1	7.5	Belted to 30-inch two-drum sander.
1	10	Belted direct to 18-inch rip saw.
1	5	Belted direct to sticker.
1	5	Belted to shaper.
1	3	Belted to cut-off saw.
1	3	Belted direct to dowel machine.
1	3	Belted direct to band saw.

The Come Pact Furniture Company, Ann Arbor, Mich. Group drive. Running hours per week, 60.

Total connected horsepower, 35; average kilowatt-hours per month, 2,500; average kilowatt-hours per month, per connected horsepower, 71.3.

MOTOR INSTALLATION.

The installation at this plant consists of a 35-horsepower, three-phase, sixty-cycle, 220-volt, 1,800-revolution-per-minute motor, belted to a line shaft to which are connected a band saw, mortiser, tenon machine, trimming machine, boring machine, three drum sanders, one small blower and one automatic-gauge lathe.

Ft. Smith Couch & Bedding Company, Ft. Smith, Ark. Manufacturer of high-grade couches. Combination drive. Running hours per week, 60.

Total connected horsepower, 42.5; total number of motors installed, 8; average kilowatt-hours per month, 380; average kilowatt-hours per month per connected horsepower, 8.95.

Kilowatt-hour consumption for six months (1911): July, 360; August, 360; September, 312; October, 456; November, 300; December, 492.

MOTOR INSTALLATION.

The motors in this plant are all 220-volt, two-phase, sixty-cycle machines operating at 1,800 revolutions per minute. The following includes a list of the motors installed, with their respective drives.

No.	Horsepower	Application.
1	7.5	Belted direct to a double-end cut-off saw.
1	5	Belted direct to a 24-inch planer.
1	5	Belted direct to trimming saw.
1	5	Belted direct to 16-inch hand jointer.
1	5	Belted direct to swing cut-off saw.
1	5	Belted direct to belt sander.
1	5	Belted direct to 36-inch band saw.
1	5	Belted to line shaft driving one triple boring machine, one tenoner, one emery wheel, one single-spindle shaper and one tufting machine.

Hafner Furniture Company, Chicago, Ill. Manufacturer of sofas and couches. Combination drive. Running hours per week, 60.

Total connected horsepower, 102.5; number of motors installed, 19; average kilowatt-hours per month, 4,300.

Kilowatt-hour consumption for twelve months: January, 4,428; February, 7,440; March, 6,828; April, 5,244; May, 5,448; June 4,332; July, 2,592; August, 1,896; September, 2,028; October, 3,564; November, 3,948; December 4,336.

MOTOR INSTALLATION.

The motors in this installation are all 220-volt, shunt-wound, direct-current machines. The following includes a list of the motors installed, with their respective drives.

No.	Horsepower	Speed, R. P. M.	Application
1	15	1,000	Direct-connected to eight-inch sticker and No. 2 blower.
1	10	900	Belted direct to 28-inch planer and No. 1 blower.
1	15	700	Belted direct to 42-inch sander and No. 2 blower.
1	10	1,250	Belted direct to automatic rip saw.
1	7.5	1,525	Belted direct to double cut-off saw.
1	2	1,650	Belted to disk sander.
1	3	1,650	Belted to table sander and No. 1 blower.
1	2	1,900	Belted direct to belt sander.
1	3	1,650	Belted direct to 18-foot band saw.
1	5	1,650	Belted direct to 18-foot band saw.
1	3	1,650	Belted direct to trim saw.
1	1	1,100	Belted to two-spindle boring machine.
1	5	1,650	Direct-connected to two-spindle shaper.
1	5	1,100	Belted to line shaft driving embossing machine, six-spindle adjustable boring machine, reamer and turning lathe.
1	0.5	220	Belted to 30-inch graining machine and No. 0 blower.
1	2	1,100	Belted direct to two hydraulic presses.
1	3	1,650	Belted direct to buck shaper.

There are also installed in this plant six portable electric boring machines and three motor-driven sewing machines.

Iron and Steel Mill Data—Sheet No. 2.

Rail re-rolling mill which buys wornout steel rails and re-rolls them into good rails of smaller section, an average of 800 30-foot rails being re-rolled daily. There are 125 men employed working 12 hours per day. Two hot saws in the plant are driven by a 100-horsepower steam engine.

Total connected horsepower, 1,020. Total number of motors installed, 14. Average kilowatt-hours per month, 158,333.

Kilowatt-hour consumption for 12 months:

Month	Kilowatt-Hours.	Month	Kilowatt-Hours.	Month	Kilowatt-Hours.
June	158,800	October	163,100	February	180,400
July	119,800	November	181,100	March	190,400
August	129,900	December	177,000	April	167,600
September	161,300	January	173,100	May	177,500

Load-factor, 28 per cent; operating-time load-factor, 49 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts. Motor, except those on cranes are of the squirrel-cage induction type.

No.	Horse-Power-	Speed R. P. M.	Application.
1	100	825	Double-shaft extension, one pully belted to a 60-inch cold saw, the other pulley belted through a 15-foot three-hanger shaft to a Gould 3.25-inch by 4-inch triplex pump, supplying hydraulic pressure for moving tables.
1	75	850	Belted to a 204-foot shaft (25 hangers) driving four Lewis Foundry & Machine Company straightening presses; six Niles four-spindle drills; two Bates straightening presses; one double emery wheel; and one machine for pulling rails on tables.
1	7.5	1,700	Connected by chain to straightening press.
1	7.5	1,700	Belted to straightening press.
1	20	1,120	Belted to a 50-foot shaft (seven hangers) driving two engine lathes; two 14-inch lathes; one saw-grinding machine; one Powell planer; one 16-inch shaper; one hack saw; two small drills; one 18-inch forge blower; and one emery wheel.
1	7.5	840	Slip-ring motor geared to the hoist of a six-ton crane.
1	5	1,120	Slip-ring motor geared to bridge of above.
1	7.5	840	Slip-ring motor geared to hoist of six-ton crane.
1	5	1,120	Slip-ring motor geared to trolley of above.
1	10	1,120	Slip-ring motor geared to bridge of above.
1	50	850	Belted to Buffalo Forge No. 10 steel-plate fan.
1	75	850	Belted to an eight-foot shaft driving one transfer table which takes rails from furnace and transfers them to roll-feeding tables; and one Buffalo Forge No. 11 steel-plate fan.
2	325	160	Driving main mill rolls.

Steel plant, manufacturing sheet-steel tanks. The process consists of rolling the steel, cutting, forming and welding the tanks after which they are enameled and baked. The average daily output is 120 tanks. 30 men are employed working in two shifts of 10 hours each.

Total connected horsepower, 45. Total number of motors installed, 2. Average kilowatt-hours per month, 3,404.

Kilowatt-hour consumption for 12 months:

Month	Kilowatt-Hours.	Month	Kilowatt-Hours.	Month	Kilowatt-Hours.
June	3,160	October	2,000	February	4,315
July	2,900	November	2,666	March	5,315
August	3,240	December	5,240	April	3,700
September	2,370	January	4,810	May	4,540

Load-factor, 14 per cent.

The electrical energy consumed for each tank produced is 1.3 kilowatt-hours.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 22 volts. Motors are of the squirrel-cage induction type.

No.	Horse-Power	Speed R. P. M.	Application
1	30	1,700	Belted to a five-foot shaft (two hangers) and a 20-foot countershaft (four hangers) driving one Bury 10-inch by 10-inch horizontal air compressor, 80 pounds pressure, supplying air to a size 8, Pangburn sand blast; two 38-feet by 48-feet grinding mills; and one three-inch single-cylinder plunger pump.
1	15	1,120	Belted to a 35-foot shaft (seven hangers) and two two-hanger countershafts driving one G. A. Ohl 7-foot wide sheet-metal press, flywheel 36-inch diameter, rim 7 by 4 inches; one Niagara No. 262 shear, flywheel 20 inch diameter, rim 4 by 2 inches; one Canedy Otto Manufacturing Company No. 15 20-inch drill; one No. 12 double carborundum wheel, 8 by 1 inches; and one Niagara No. 4 punch, driven flywheel 28 inches diameter, rim 4 inches by 2 inches.

Knitting Mill Data.

The term load-factor is used in these data in such a sense that a load-factor of 100 per cent represents the use for 24 hours every day of power corresponding to the rated capacity of the motors connected. An operating-time load-factor of 100 per cent represents the use of the rated capacity of the motors for the running hours per day specified for each installation.

Knitting mill manufacturing a high grade of men's union suits. Average output 100 dozen garmens per day. Thirty-five people are employed.

Total connected horsepower, 15. Number of motors, 2. Average kilowatt-hours per month, 1,493.

Kilowatt-hour consumption for 11 months: December, 1,722; January, 1,663; February, 1,659; March, 1,301; April, 1,886; May, 1,304; June, 1,569; July, 1,263; August, 1,091; September, 1,609; October, 1,358.

Load-factor, 18 per cent.

The electrical energy consumption per 1,000 garments manufactured is 50 kilowatt-hours.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts. Motors are of the squirrel- cage induction type.

No.	R. P. M. power	Speed Horse-	Application.
1	10	1120	Belted to a 32-foot shaft, six hangers, and two countershafts driving 16 Stafford & Holt circular knitting machine, varying in size from 13 to 22 inches in diameter; one George W. Payne 48-spindle winder; and one small double emery wheel.
1	5	1120	Belted to two 32-foot shafts, 442 revolutions per minute, driving 28 small machines (sewing machines, stitchers, seamers, etc.) made by Singer, Metropolitan and Union Companies.

Hosiery plant manufacturing an average of 300 dozen pairs of men's, women's and children's stockings per day. Eighty persons are employed working 10 hours per day.

Total connected horsepower, 40. One motor. Average kilowatt-hours per month, 3,817.

Kilowatt-hour consumption for 12 months: April, 5,350; May, 4,680; June, 3,960; July, 3,660; August, 4,560; September, 4,710; October, 4,200; November, 4,470; December 3,660; January, 2,980; February, 3,200; March, 3,380.

Load-factor, 17 per cent; operating-time load-factor, 41 per cent.

The electrical energy consumption per 1,000 pair of stockings is 46.8 kilowatt-hours.

MOTOR INSTALLATION.

The supply source is three-phase, 60 cycles, 400 volts. Motor is a squirrel-cage induction machine.

No.	Horse-power.	Speed R. P. M.	Application.
1	40	580	Belted to two 110-foot line shafts, 12 hangers each, and 19 countershafts, 720 feet, 108 hangers, driving 113 Stadard knitting machines; 14 Mayo knitting machines; 30 New Victor knitting machines; two George Lindsley 24-bobbin winders; 74 Michael & Wildman knitting machines; 34 William Beattie 18-inch loopers; one Hodge 250-ton screw press, consisting of eight 34 by 42-inch steam-heated plates; one 30-inch ventilating fan, pulley 5 by 2 inch; one 30-inch fan circulating air in a 6 by 6 by 4-foot drying oven; two 30-inch fans circulating air an 8 by 8 by 8-foot drying oven; 24 Crompton & Knowles looms; one National 48-bobbin winder; and two Atherton Machine Company warping frames.

Knitting mill manufacturing a general line of knit goods. Twenty persons are employed. The average output is 60 dozen garments per day.

Total connected horsepower, 25. Total number of motors installed, 2. Average kilowatt-hours per month, 204.

Kilowatt-hour consumption for 12 months: January, 182; February, 208; March, 134; April, 275; May, 131; June, 90; July, 128; August, 128; September, 120; October, 138; November, 166; December, 754.

Load-factor, 1.5 per cent.

The electrical energy consumption per 1,000 garments manufactured is 10 kilowatt-hours.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts. Squirrel-cage induction motors are used.

No.	Horse-power.	Speed R. P. M.	Application.
1	20	1680	Belted to 70 feet of line shafting, 17 hangers, driving one 5-kilowatt 110-volt generator; one G. W. Payne 48-spindle winder; one cloth turner; 11 Scott & Williams circular interlock knitting machines of the following diameters: one 17-inch, one 16-inch, two 15-inch, one 14-inch, one 13-inch; one 12-inch, one 11-inch, one 10-inch and one 8-inch.
1.	5	1700	Belted to a 45-foot line shaft, seven hangers, driving one Singer seamer; two Metropolitan seamers; one Merrow edger; one Union special cover seamer; two Metropolitan staying machines; one Singer finisher, one Merrow shell; one Wheeler & Wilson tucker; one small emery wheel; and one small buffing wheel.

Laundry Power Data—Sheet No. 1.

The Imperial Sanitary Laundry, Mobile, Ala., does a general laundry business. Individual drive. Running hours per week, 56.

Total connected horsepower, 20; total number of motors installed, 15; average kilowatt-hours per month, 1,960; load-factor, 21 per cent.

Kilowatt-hours consumption for 12 months: 1910: January, 430; February, 1,600; March, 1,410; April, 1,600; May, 1,900; June, 2,540; July, 2,650; August, 2,560; September, 2,390; October, 1,670; November, 2,460; December, 2,310.

MOTOR INSTALLATION.

The following includes the list of motors installed with their respective drives. All motors use direct current operating at 220 volts:

No.	Horse-power	Speed R. P. M.	Application
2	2	1,200	Vertical motors, each belted to a 26-inch extractor.
1	7.5	1,200	Belted to line shaft driving five 100-shirt washers.
1	1.5	830	Geared to one 4-roll mangle.
1	.5	830	Geared to one collar table.
1	1	830	Geared to one collar mangle.
1	1	830	Geared to one shirt-bosom press.
1	.5	830	Geared to one shirt-body ironer.
1	.33	830	Geared to one shirt-body ironer.
1	.33	830	Geared to one collar dampener.
1	1	830	Geared to one fan in dry room.
1	.25	830	Belted to one collar starcher.
1	.25		Geared to one blower for gas irons.
1	.20	830	Belted to one cuff starcher.
1	1	1,265	Belted to one gas-making machine.

Palmer House Laundry, Chicago, Ill. Does a general hotel laundry business. Group and individual drive. Running hours per week, 60.

Total connected horsepower, 63. Total number of motors installed, 8. Average kilowatt-hours per month, 5,650. Load-factor, 34 per cent.

Kilowatt-hours consumption for 9 months: 1911: January, 5,564; February, 5,881; March, 5,764; April, 5,763; May, 5,981; June, 5,951; July, 5,428; August, 5,651.

MOTOR INSTALLATION.

This installation consists of the following, all motors being 220-volt direct-current machines:

No.	Horsepower	Application
1	15	Belted to a shaft driving a 40 by 63-in. washer; one 30 by 45-in. washer, one 32 by 44-in. washer.
1	15	Driving a 34 by 48-in. washer, a 23 by 44-in. washer, and a 24-in. extractor.
1	7.5	Belted direct to a 40-inch extractor.
1	7.5	Belted direct to a 36-inch extractor.
1	5	Belted direct to a 26-inch extractor.
1	5	Belted direct to a 48-inch exhaust fan.
1	5	Belted to a 6-roll mangle.
1	3	Belted direct to a 4-roll mangle.

The manager of this laundry is exceptionally enthusiastic over the improved results obtained since the installation of central-station service. This laundry is conducted in connection with the hotel business of the Palmer House Company and previously was driven from a line shaft driven from the steam engine in the hotel's engine room. Writing of central-station service, the manager states: "I don't think any form of power can compare with central-station service. I have been in the business 20 years, but it is only since the adoption of Edison service in this plant that I have ever really enjoyed my work. I cannot recommend it too strongly."

The Model Laundry, Scottdale, Pa. Does a general laundry business. Group and individual drive. Running hours per week, 57.

This plant is equipped with modern machinery made by the American Laundry Machinery Company and does work having an average value of $100 per day. Four men and eight girls are employed.

The total capacity of twelve horsepower in squirrel-cage induction motors is installed, having a maximum demand of six horsepower and a load-factor of 25 per cent. Energy supplied is 2-phase, 60-cycle, 220-volt.

Kilowatt-hours consumption for 8 months: 1911: January, 276; February, 743; March, 726; April, 706; May, 744; June, 673; July, 709; August, 768.

MOTOR INSTALLATION.

No.	Horse-power	Speed R. P. M.	Application
1	1	1,700	Back-geared and belted to 4-loop Hagen dry room.
1	2	1,700	Belted to 120-inch Hagen flat-work roll.
1	2	1,700	Belted to a 20-foot, 4-hanger line shaft driving one bosom press, one sleeve roll, one body roll, one Simplex No. 2 air compressor for operating one cuff press, one yoke press and 2 collar presses.
1	1	1,700	Belted to a 12-foot, 2-hanger line shaft driving one 2-loop Hagen dry room, one 14-inch Bishop starcher and one Harriman collar dampener.
1	1	1,700	Belted to a 12-foot, 3-hanger line shaft driving one collar shaper, one collar folder and one 24-inch collar and cuff ironer.
1	5	1,700	Belted to a 20-foot, 5-hanger line shaft driving one 36 by 48-inch washer; two 33 by 48-inch washers and one 26-inch extractor.

Laundry Power Data—Sheet No. 2.

The Schrupp Laundry, Chicago, Ill. Does a general laundry and cleaning business. Group drive. Running hours per week, 59.

Total connected horsepower, 23; total number of motors installed, 6; average kilowatt-hours per month, 2,600

Kilowatt-hours consumption for twelve months: 1910: March, 2,436; April, 2,601; May, 2,460; June, 2,605; July, 2,689; August, 2,411; September, 3,011; October, 2,964; November, 2,880; December, 2,937. 1911: January, 2,992; February, 3,062.

MOTOR INSTALLATION.

All motors are 220-volt induction motors operating at 1,800 revolutions per minute. The installation consists of the following:

No.	Horsepower	Application
1	5	Belted to line shaft to which is connected a Nelson-Kruder No. 9 washing machine, Nelson-Kruder No. 3 washing machine, and American 26-in. extractor, a Nelson-Kruder bosom ironer and sleeve ironer. The two latter machines are belted to this shaft through the floor, being located above the washing department.
1	5	Belted to a counter shaft driving a Nelson-Kruder body ironer, a neck-band ironer, 2 Nelson-Kruder No. 3 washers and a 24-inch ventilating fan.
1	5	Belted to a shaft driving 2 Nelson-Kruder No. 3 washers, 2 American No. 2 washers, one bosom ironer and one 24-inch American extractor.
1	2	Belted to a Barnes & Erb collar ironer and a Nelson-Kruder body ironer.
1	3	Driving a Barnes & Erb No. 16 bosom starcher, a Bishop cuff starcher, a Bishop collar starcher and 2 Barnes & Erb dry rooms.
1	3	Belted direct to a counter shaft driving a Hagen 4-roll mangle and W W. W. shaker.

This plant also employs nine 250-watt electric flat ironers equipped with automatic cord regulators and pilot lamps. Views of the Schrupp Laundry are shown in the illustrations accompanying this article.

Palace Laundry, Oklahoma City, Okla. Does a general laundry business. Combination drive. Running hours, per week, 60.

Total connected horsepower, 42; total number of motors installed, 24; average kilowatt-hours per month, 3,144; load-factor, 16 per cent.

Kilowatt-hours consumption for 10 months: January, 2,218; February, 3,193; March, 3,628; April, 3,389; May, 3,524; June, 4,163; July, 4,096; August, 3,953; September, 3,630; October, 1,867.

MOTOR INSTALLATION.

This installation consists of 220-volt motors as follows:

No.	Horse-power	Speed R. P. M.	Application
2	2	1,100	Direct-connected to two 26-inch extractors.
1	10	650	Belted to a line shaft driving four 100-shirt washers, two 150-shirt washers, one 50-shirt washer and one 36-inch exhaust fan.
1	10	650	Belted to a line shaft driving four 150-shirt washers, three 26-inch exhaust fans and a tumbler.
2	1	450	Each direct-connected to a 36-inch exhaust fan.
1	3	850	Geared to 4-roll mangle.
1	3	1,050	Geared to 4-roll mangle.
2	1	900	Belted to 2 dry rooms.
1	1/8	1,000	Geared to collar dampener.
1	1/8	1,500	Geared to collar starcher.
1	1/2	450	Belted to 24-inch extractor. Vertical motor
1	1/6	1,200	Geared to band starcher.
1	1/8	1,000	Geared to neck-band ironer.
3	1/4	800	Each geared to a sleeve ironer.
1	1/3	1,000	Geared to body ironer.
1	1/3	620	Geared to body ironer.
1	2	1,000	Geared to rotary blower.
1	1/2	1,025	Geared to bosom press.
1	3/4	900	Geared to collar mangle.
1	1/2	600	Geared to collar table.

This laundry has individual drive throughout with exception of washing machines. There is also installed one 100-horsepower boiler for heating and washing purposes, burning natural gas; average consumption of gas per month is 1,200,000 cubic feet; employ one fireman at $60 per month.

The following is a brief summary of data of a few plants using central-station service:

Plant No.	No. of Motors	Total Horsepower.	Average Kilowatt-hours per Month.	No. of Hours per Week in Operation.
I	8	23	2,551	60
II	3	18	1,000	57
III	6	12	690	57
IV	15	20	1,960	56
V	8	63	5,650	60
VI	6	23	2,600	60
VII	24	42	3,144	60
VIII	6	18	2,005	60
IX	8	28	2,414	60
X	6	25	2,587	60

The average load-factor of laundries is 20 per cent.

Lumber-Mill Data—Sheet No. 1.

The term load-factor is used in these data in such a sense that a load-factor of 100 per cent represents the use for 24 hours every day of power corresponding to the rated capacity of the motors connected. An operating-time load-factor of 100 per cent represents the use of the rated capacity of the motors for the running hours per day specified for each installation.

Saw mill, located in northern Wisconsin. This plant saws hardwood logs into various sizes of timber. The output is from 20,000 to 40,000 feet of lumber per 10-hour day.

Total connected horsepower, 95. Total number of motors installed, 4. Average kilowatt-hours per month, 2,267

Kilowatt-hour consumption for 9 months: June, 1,600; July, 2,470; August, 4,000; September, 3,710, October, 2,130; November, 2,300; December, 1,410; January 580; February, 2,210.

Load-factor, 4.3 per cent; operating-time load-factor, 12.4 per cent.

The electrical energy consumption per 1,000 feet of lumber is 3.5 kilowatt-hours.

MOTOR INSTALLATION.

The following is a list of the motors installed, with their respective drives. The supply source is three-phase, 60 cycles, 440 volts.

No.	Horse-power.	Speed R. P. M.	Application.
1	75	690	Slip-ring motor belted to a 10-foot shaft driving two Sinker Davis Company circular log saws, one 30-inch and one 48-inch saw, speed of saws 7,000 feet per minute; one traveling carriage for above saws driven by rack and pinion; one log haul, 60 feet long; one 20-foot chain conveyor; and one Gordon Grate Company 32-inch edger
1	10	1,700	Squirrel-cage motor belted to shaft driving one Cordesman, Meyer & Company 30-inch by one-inch band saw; and one combination 18-inch saw bench.
1	5	1,700	Squirrel-cage motor belted to shaft driving one 24-inch swing cut-off saw; and one 20-foot chain conveyor.
1	5	1,700	Squirrel-cage motor belted to shaft driving a 20-inch swing cut-off

Lumber mill dealing principally in dressed lumber. Approximately 1,000,000 feet of lumber of various grades, are worked per month, while the maximum capacity is 1,700,000 feet. Operates 10 hours per day.

Total connected horsepower, 387.5. Total number of motors installed, 8. Average kilowatt-hours per month, 48,110.

Kilowatt-hour consumption for 12 months: April, 22,200; May, 45,480; June, 38,140; July, 52,710; August, 57,920; September, 44,840; October, 59,080; November, 54,440; December, 47,630; January, 45,540; February, 50,800; March, 58,540.

Load-factor, 22.7 per cent.

The electrical energy consumption per 1,000 feet of lumber worked is 48.1 kilowatt-hours.

MOTOR INSTALLATION.

The supply source is three-phase, 25 cycles, 440 volts. Motors are all of the squirrel-cage type.

No.	Horse-power.	Speed R. P. M.	Application.
1	150	480	Belted to a 70-foot shaft (16 hangers) and 32 feet of countershafting driving one Berlin 12-inch self-feed rip saw; one Berlin No. 94, 15-inch by 6-inch planer and matcher; one Homes 14-inch swing cut-off saw; one W. S. Sherman three-head end matcher; one Connell & Dengler 8-inch planer and matcher, one Connell & Dengler 10-inch planer and matcher; one Connell & Dengler 26-inch double surfacer; one Connell & Dengler 24-inch circular resaw; one S. A. Woods No. 24 planer and matcher; and one Buffalo No. 3 20-inch blower.
1	50	475	Flexibly connected to a Connell & Dengler 60-inch by 5-inch band re-saw.
1	50	720	Direct-connected to a Buffalo 60-inch steel-plate fan.
1	20	710	Belted to a 15-foot shaft (three hangers) and a 10-foot countershaft driving one H. B. Smith 6-inch, 4-side molder, 12-inch pulley; and one Greenlee Brothers self-feed rip saw, 22-inch maximum diameter saw used.
1	100	480	Belted to 60-foot shaft and 103 feet of countershaft driving four 12-inch swing cut-off saws; one 12-inch planer and matcher; one 14-inch planer and matcher; one 48-inch by 5-inch band resaw; one 14-inch swing cut-off saw; one Witherby No. 30 double-trim saw; one 12-inch double rip saw; two 30-inch steel-plate exhaust fans; and one 14-inch fan.
1	5	....	Belted direct to a 14-inch blower, 500 revolutions per minute.
1	7.5	710	Belted to a line shaft driving one 28-inch cut-off saw; and one 10-foot 45-degree conveyor to carry shavings from cyclone to baling press.
1	5	700	Belted to 25-foot line shaft driving one knife grinder; one 10-inch speed lathe; one double emery wheel; one 12-inch drill; and one band-saw stretcher.

Mattress Manufacturing Data—Sheet No. 3.

Louisville Pillow Company, Louisville, Ky. This plant manufactures a line of mattresses of various grades, pillows and comforts. The average output is 250 mattresses per 10-hour day.

Total connected horsepower, 167.5. Total number of motors installed, 12. Average kilowatt-hours per month, 10,886.

Kilowatt-hour consumption for 12 months: November, 14,380; December, 11,380; January, 9,100; February, 7,930; March, 10,880; April, 10,940; May, 7,760; June, 11,320; July, 12,910; August, 9,500; September, 10,830; September, 13,710.

Load-factor, 11.8 per cent; operating-time load-factor, 37 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts.

No.	Horse-power.	Speed R. P. M.	Application.
2	25	985	Each belted direct to a shoddy picker, drum 30 inches diameter, 26-inch face
2	30	950	Each belted direct to a shoddy picker, drum 32 inches diameter, 26-inch face. Above pickers manufactured by Diamond Textile Machine Works.
1	5	1,200	Belted to line shaft driving Singer sewing machines.
2	10	1,200	Each belted direct to a felting machine, capacity 1,000 pounds per 10-hour day, each.
1	5	1,200	Belted to a countershatt driving one cotton picker; and one 30-inch fan. Capacity of picker, 800 pounds per hour.
1	5	1,200	Belted direct to a felting machine, capacity 100 pounds per hour.
1	7.5	1,200	Belted direct to excelsior picker.
1	5	1,200	Belted direct to mattress-filling machine.
1	10	1,120	Belted to a line shaft driving three cotton pickers, capacity 400 pounds per hour, each.

Energy is supplied by the Louisville Lighting Company.

Small mattress plant having an average output of 40 mattresses per day. Nine men are employed working 9.5 hours per day.

Total connected horsepower, 8. Total number of motors installed, 2. Average kilowatt-hour consumption per month, 292.

Kilowatt-hour consumption for 12 months: January, 191; February, 203; March, 155; April, 207; May, 261; June, 295; July, 249; August, 325; September, 344; October, 345; November, 395; December, 432.

Load-factor, 6.7 per cent; operating-time load-factor, 19 per cent.

The approximate electrical energy consumed per mattress manufactured is 0.3 kilowatt-hour.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is two phase, 60 cycle, 220 volts and single-phase.

No.	Horse-power.	Speed R. P. M.	Application.
1	0.5	1,200	Belted to 15-foot shaft, 362 revolutions per minute, driving three Singer sewing machines. Single-phase motor.
1	7.5	1,200	Belted to 32-foot shaft, 336 revolutions per minute, driving one straw twister; one Thompson 22-inch diameter cotton picker, 692 revolutions per minute; one 20-inch blower, 1,447 revolutions per minute; one Thompson excelsior picker, 16-inch diameter, 1,154 revolutions per minute; one Wareham mattress stuffer; and one Singer stitcher.

Empire Mattress Company, Chicago, Ill. This plant manufactures high grade mattresses, the average output being 500 mattresses per week. Running hours per week, 57.

Total connected horsepower 37.5. Total number of motors installed, 6. Average kilowatt-hours per month, 3,791.

Kilowatt-hour consumption for 12 months: November, 2,153; December, 2,751; January, 1,660; February, 4,548; March, 5,561; April, 4,502; May, 4,155; June, 4,097; July, 3,386; August, 3,962; September, 4,414; October, 4,304.

Load-factor, 18.6; operating-time load-factor, 61 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts.

No.	Horse-power.	Speed R. P. M.	Application.
1	10	1,200	Belted to a 16-foot line shaft driving two Smith & Furbush felting machines, capacity 150 pounds per hour, each.
1	7.5	1,700	Belted to a six-foot shaft driving one condenser, capacity 600 pounds per hour; and one No. 5 Sturtevant blower.
1	10	1,700	Belted to line shaft driving one Smith & Furbush felting machine, capacity 150 pounds per hour; and one willow, for cleaning and mixing stock.
1	5	1,200	Belted to 20-foot line shaft driving two cotton pickers; and one hair picker, capacity 500 pounds per hour.
1	3	1,700	Belted to line shaft driving 14 Union Special and Wheeler & Wilson factory sewing machines.
1	2	1,700	Belted to line shaft driving one excelsior picker; and four mattress-filling machines.

Energy is supplied by the Commonwealth Edison Company.

Paint and Varnish Plants.

The term load-factor is used in these data in such a sense that a load-factor of 100 per cent represents the use for 24 hours every day of power corresponding to the rated capacity of the motors connected. An operating-time load-factor of 100 per cent represents the use of the rated capacity of the motors for the running hours per day specified for each installation.

T. H. Nevin Paint Company, Pittsburgh, Pa. This company has an average output of 1,000 gallons of paint per day and does a business of $300,000 per year. Combination drive.

Total connected horsepower, 85. Number of motors, 5. Average kilowatt-hours per month, 16,263.

Kilowatt-hour consumption for 10 months: January, 13,020; February, 9,810; March, 8,000; April 11,690; May, 18,590; June, 20,480; July, 20,790: August, 25,610; September, 17,300; October, 17,340.

Load-factor, 35 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60-cycles, 220 volts.

No.	Horse-power.	Speed, R. P. M.	Application.
1	15	850	Belted to a line shaft driving two putty chasers.
1	20	850	Belted to a line shaft driving five paint mixers, and five paste mixers.
1	20	850	Belted to a line shaft driving five paint mixers; seven 16-inch stones; two large chasers; and four 30-inch stones.
1	25	1,120	Belted to a line shaft driving one double run of stones; one single run of stones; and four paste mixers.
1	5	1,700	Geared direct elevator.

Energy is supplied by the Allegheny County Light Company.

Paint and putty company, does a business of about $52,000 per year in paints and putty. Has an output of 3,000 pounds of putty and 7,000 pounds of paint per day. There are six men employed working 10 hours per day.

Total connected horsepower, 30. One squirrel-cage induction motor is installed. Average kilowatt-hours per month, 1,019.

Kilowatt-hour consumption for 12 months: July, 847; August, 882; September, 824; October, 951; November, 1,124; December, 1,070; January, 770; February, 1,117; March, 1,451; April, 1,341; May, 1,321; June, 540.

Load-factor, 6.2 per cent; operating-time load-factor, 15.4 per cent.

The approximate electrical energy-consumption per ton of paint and putty manufactured is 8 kilowatt-hours.

MOTOR INSTALLATION.

No.	Horse power.	Speed, R. P. M.	Application.
1	30	850	Belted to a 15-foot shaft (four hangers) with 27 feet of countershafting, driving three 16-inch stone mills for grinding paints; two paint Chaser mills; one 36-inch stone mill; one 20-inch stone mill; one 15-gallon paint mixer; one 40-gallon paint mixer; four agitating tanks of 35 gallons capacity each; one 5-gallon iron mill; one can-seaming machine.

Peaslee-Gaulbert Paint Company, Louisville, Ky. This plant has an output of about 3,500 gallons of mixed paints and 12 tons of leads per week.

Total connected horsepower, 262. Number of motors, 16. Average kilowatt-hours per month, 11,769.

Kilowatt-hour consumption for 12 months: March, 13,728; April, 11,568; May, 12,432; June, 11,856; July, 7,536; August 8,004; September, 11,924; October, 14,544; November, 12,768; December, 9,320; January, 14,928; February, 12,624.

Load-factor, 10.2 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is 220 volts, direct current.

No.	Horse-power.	Speed, R. P. M.	Application.
1	25	450	Geared to line shaft driving five 72-inch chasers.
1	25	950	Belted to a line shaft driving four 48-inch mixers; and six floor-type mixers.
1	25	450	Belted to a line shaft driving six roller mills; and six burr mills.
1	25	450	Each geared to a line shaft driving four 30-inch burr mills; and three 20-inch mills.
1	22	950	Belted to shafting driving five 20-inch burr mills; two 18-inch burr mills; eleven 15-inch burr mills; eleven 12-inch iron mills; 30 150-gallon vertical mixers; and four 450-gallon horizontal mixers.
2	20	550	Belted to putty mills.
1	2	1,800	Belted to shaft driving two small printing presses.
8	10	.....	Each direct-connected to elevator mechanism.

Energy is supplied by the Louisville Lighting Company.

Pumping Data—Sheet No. 1.

The term load-factor is used in these data in such a sense that a load-factor of 100 per cent represents the use for 24 hours every day of power corresponding to the rated capacity of the motors connected. An operating-time load-factor of 100 per cent represents the use of the rated capacity of the motors for the running hours per day specified for each installation.

Minot City Water Pumping Plant, Minot, N. D. Population, 4,125. Individual drive. Running hours per week varies.

Total connected horsepower, 246.5. Number of motors installed, 11. Average kilowatt-hours per month, 13,490. Average kilowatt-hours per month per horsepower connected, 54.

Kilowatt-hour consumption for 8 months: January, 10,700; June, 15,230; July, 13,090; August, 17,700; September, 16,100; October, 12,200; November, 12,000; December, 10,900.

Load-factor, 10 per cent.

Size of city reservoir is 100,000 gallons. Average monthly supply of water pumped, 9,365,649 gallons.

Average number of gallons pumped per kilowatt-hour, 694.

Average number of gallons used per day, 312,188.

Average kilowatt-hour consumption per 1,000,000 gallons, 1,440.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts.

No.	Horse-power.	Speed R. P. M.	Application.
2	100	690	Each geared direct to two 10 by 12-inch horizontal, duplex, outside-center-packed plunger-type pumps, manufactured by Fairbanks, Morse & Co. Capacity, 700 gallons per minute against 375-foot head at 45 revolutions per minute.
2	7.5	1200	Each direct-connected to centrifugal pumps, capacity of each 750,000 gallons daily. Manufactured by Lawrence Pump & Engine Co These pumps are used for pumping water from river into forebay.
1	20	900	Direct-connected to one centrifugal pump, capacity 1,500 gallons per minute; manufactured by Lawrence Pump & Engine Co. This pump is used only for washing the filter beds, which under ordinary conditions is not done oftener than once per day, requiring about one hour.
1	7.5	1,200	Geared direct to one 12 by 8-inch duplex air compressor. The discharge of this compressor is into the main air line which has connection into the air system of each filtering bed.
4	0.5	1,800	Each direct-connected to one chemical mixer.
1	2	1,800	Direct-connected to one agitator.

This pumping station is arranged in duplicate in case of breakdown or emergency. Energy is supplied by the Minot Light & Telephone Company.

El Reno Water Company, El Reno, Okla. Population, 7,872. Individual drive. Running hours per week, 144.

Total connected horsepower, 115. Number of motors installed, 4. Average kilowatt-hours per month, 12,806. Average kilowatt-hours per month, per connected horsepower, 111.

Kilowatt-hour consumption for 9 months: April, 14,260; May, 10,890; June, 10,770; July, 10,390; August, 17,184; September, 14,180; October, 10,480; November, 11,920; December, 15,180.

Load-factor, 20.4 per cent; operating-time load-factor, 23.8 per cent.

The average electrical energy consumption per 1,000 gallons of water pumped is 1.06 kilowatt-hours.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is two-phase, 60 cycles, 220 volts.

No.	Horse-power.	Speed R. P. M.	Application.
1	40	1,200	Direct-connected to one 10 by 12-inch Deane pump, capacity 204 gallons per mmute at 25 strokes.
1	40	1,800	Direct-connected to one five-inch three-stage centrifugal pump, capacity 500 gallons per minute at 225-foot head.
1	20	900	Direct-connected to one 7 by 8-inch Deane triplex pump, capacity 180 gallons per minute at 45 strokes.
1	15	1,800	Direct-connected to pump, pumping from six wells, 80,000 to 100,000 gallons per day.

Energy is supplied by the El Reno Gas & Electric Company.

North Crystal Lake Water Works, North Crystal Lake, Ill. Population, 1,931. The water is pumped from one well directly into the mains and stand pipe.

One 20-horsepower induction motor is installed. Average monthly kilowatt-hour consumption is 1,512.

Load-factor, 14 per cent.

Average number of gallons pumped per capita per day, 40.6. Gallons pumped per month, 2,358,000.

Average electrical energy consumption per 1,000 gallons pumped, 0.6 kilowatt-hours.

MOTOR INSTALLATION.

The motor installed in this plant is a three-phase, 60-cycle, 220-volt induction machine.

No.	Horse-power.	Speed R. P. M.	Application.
1	20	860	Direct-connected to one Keystone Driller Company's plunger pump. Pump head 34 feet; rods 2.5 inches; working barrel 7.75 inches. Capacity 250 gallons per minute.

Energy is supplied by the Public Service Company of Northern Illinois.

Data for Refrigeration in Butcher Shops—Sheet No. 1.

The term load-factor is used in these data in such a sense that a load-factor of 100 per cent represents the use for 24 hours every day of power corresponding to the rated capacity of the motors connected.

David C. Bradley, Philadelphia, Pa.

Individual drive. Two 25-ton Vilter refrigerating machines, brine pump, well pump, elevator. Cooling by brine circulation one meat box or cooler 60 by 17 by 12 feet to 35 degrees; three freezers each 20 by 20 by 11 feet to 15 degrees; pickling or corning room 37 by 19 by 11 feet; making total of 33,173 cubic feet. The wall cases and counter cases are also cooled, thus enabling the display of choice cuts.

Total connected load, 114.75 horsepower. Maximum demand, 40 kilowatts. Average kilowatt-hours per month, 3,356.

Load-factor, 4 per cent, equals use of entire equipment for about one hour per day

Kilowatt-hours per month: January, 1,830; February, 1,740; March, 1,860; April, 2,400; May, 3,510; June, 4,550; July, 5,640; August, 5,170; September, 4,530; October, 3,980; November, 2,720; December, 2,340.

MOTOR INSTALLATION.

The following is a list of the motors installed.
All are direct-current 220-volt machines.

Number.	Horse-power.	Application.
2	50	Northern motors driving through silent chain Vilter compressor No. 1 10 by 20 inches, double-acting, single cylinder, 25-ton, 400 revolutions per minute.
1	5	Northern motor driving Triplex plunger brine pump, silent chain.
1	3.75	Northern motor driving Triplex pump for condenser water.
1	6	Slow-speed motor for freight elevator with platform 5 by 5 feet.

T. D. Bowker, Boston, Mass.

Individual drive. Automatic refrigerating machine, cooling meat box, small freezer for sweetbreads, squabs, etc., show cases, corned-beef tank, butter cabinet and cheese case.

One 15-horsepower motor with belt drive to eight-ton compressor. Average kilowatt-hours per month, 2,050.

Load-factor, 24.9 per cent; equals six hours' daily use of machine.

Kilowatt-hour consumption for 12 months: January, 732; February, 880; March, 748; April, 936; May, 1,664; June, 2,816; July, 3,280; August, 3,444; September, 3,388; October, 3,012; November, 2,592; December, 1,112.

Wilson and Rogers, Philadelphia, Pa.

Individual drive. Eight-ton Remington refrigerating machine, double-acting, two cylinders, cooling meat box 20 by 82 feet containing 13,000 cubic feet, 35 electric lamps, two doors in constant use. Twenty-horsepower Westinghouse motor, type S Westinghouse regulating rheostat for variable speed. 560 to 1,160 revolutions per minute through 10 steps. Usually operated on slow speed. Never higher than 128 revolutions per minute. Head pressure, 90 pounds; back pressure, 8 pounds. Power requirements of machine at different speeds are as follows: 102 revolutions, 8.7 horsepower; 108 revolutions, 9.0 horsepower; 116 revolutions, 9.56 horsepower; 122 revolutions, 9.95 horsepower; 128 revolutions, 10.2 horsepower.

There is a 2-horsepower motor on meat grinder.

Average kilowatt-hours per month, 1,817; or 1.67 kilowatt-hours per cubic foot per year.

Load-factor, 15 per cent.

Kilowatt-hours per month: January, 875; February, 768; March, 853; April, 1,323; May, 2,258; June, 2,904; July, 3,055; August, 2,837; September, 2,474; October, 1,825; November, 1,345; December, 1,283.

Fred Everett, Milton, Mass. Meat Market.

Individual drive. Automatic refrigerating machine cooling meat box 12 by 15 by 8 feet, containing 1,440 cubic feet to 36 degrees, and corned-beef tank.

Total connected load, 5 horsepower, consisting of one 5-horsepower General Electric alternating-current motor, Form L, three-phase, belted to one-ton compressor. Average kilowatt-hours per month, 448.

Load-factor, 16.3 per cent.

Kilowatt-hours per month: January, 154; February, 25; March, 101; April, 482; May, 748; June, 748; July, 906; August, 760; September, 692; October, 388; November, 166; December, 201.

Stone-Cutting Data—Sheet No. 2.

Stone-cutting plant, located in Chicago, making tombstones and monuments exclusively. Combination drive. Running hours per week, 54.

Total connected horsepower, 17. Total number of motors installed, 3. Average kilowatt-hours per month, 1,093. Kilowatt-hour consumption for 12 months: January, 972; February, 741; March, 1,029; April, 1,145; May, 1,257; June, 912; July, 1,003; August, 1,009; September, 1,155; October, 1,190; November, 1,372; December, 1,338. Load-factor, 11.9 per cent; operating-time load-factor, 35.8 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycle, 220 volts. All motors are of the squirrel-cage induction type.

No.	Horse-power,	Speed R. P. M.	Application.
1	10	1,120	Belted to a 12-foot shaft driving one Chicago Pneumatic Tool Company 6 by 6-inch air compressor, operating at 35 pounds pressure; and one Chicago Pneumatic Tool Company 8 by 8-inch air compressor operating at 70 pounds pressure. These compressors supply air to one surface polisher, three seven-eighths inch tools and one pug drill.
1	5	1,700	Belted to an 8-foot shaft driving a Smith, Whitcomb & Cook No. 2 surface polishing machine, with a 22-inch diameter maximum tool, and a 9-foot flexible arm.
1	2	1,700	Belted to a 15-foot shaft (four hangers) driving one George Oldham & Son, size 2, surfacer; one 12-inch exhaust fan; and one Buffalo No. 6 forge blower.

Energy is supplied by the Commonwealth Edison Company.

Stone-cutting plant, making marble and granite tombstones, the stones being cut by hand and power tools. Group drive. Running hours per week, 60.

One squirrel-cage induction motor, of 15 horsepower, is installed. Average kilowatt-hours per month, 1,047. Kilowatt-hour consumption for 12 months:

Month.	Kilowatt-hours.	Month.	Kilowatt-hours.	Month.	Kilowatt-hours.
April	1,088	August	1,168	December	1,120
May	1,117	September	1,022	January	955
June	1,132	October	1,014	February	978
July	676	November	1,301	March	994

Load-factor, 12.7; operating-time load-factor, 36.6 per cent.

MOTOR INSTALLATION.

The following is a list of the machines in this plant. The supply source is three-phase, 60 cycles, 220 volts.

No.	Horse-power,	Speed R. P. M.	Application.
1	15	1,120	Belted to a 40-foot six-hanger shaft driving one Curtis No. 416 8-inch by 8-inch air compressor, 50 to 60 pounds pressure, supplying air to 6 Dallet pneumatic chisels and one Dallet surfacer; one American 6-inch by 7-inch air compressor, pressure 50 to 60 pounds, used only as a reserve; and two F. R. Patch flexible arm polishers, using a 16-inch steel wheel with steel shot, a 24-inch emery wheel and an 8-inch canvas wheel for polishing.

Building-stone plant, having a monthly output of 12,000 cubic feet of sawed and planed stone.

Total connected horsepower, 225. Number of motors, 5. Average kilowatt-hours per month, 17,620. Kilowatt-hour consumption for 5 months: March, 18,500; April, 19,100; May, 17,800; June, 18,600; July, 14,100. Load-factor, 14.3 per cent.

The electrical energy consumption per cubic foot of stone cut and planed is 2.7 kilowatt-hours.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase 60 cycle, 220 volts and 220 volts direct current.

No.	Horse-power,	Speed R. P. M.	Application.
1	150	850	Drives by chain a 20-foot shaft and 285 feet of countershafting driving one gang saw for cutting stone 17 feet long; seven gang saws for cutting stone 15 feet long (six blades each); two Bedford Foundry & Machine Company open-side two-head planers, 15-foot bed; one Bedford Foundry & Machine Company double-platen 4-head planer; two New Albany Manufacturing Company 4-head planers; one 22-inch by 12-foot engine lathe; one 24-inch drill; and one 50-kilowatt, 250-volt compound-wound direct-current generator, 700 revolutions per minute, supplying the following motors.
1	15	1,000	Shunt-wound motor geared to a W. F. Meyers 5-foot diamond saw, 640 revolutions per minute.
1	20	925	Shunt-wound motor belted to 40 feet of shafting driving one double-wire saw; one 30-inch by 10-foot stone lathe; one 6-foot by 14-foot stone lathe; and one 16-inch forge blower, 1,800 revolutions per minute.
1	15	1,000	Series-wound motor operating a Bedford Foundry & Machine Company 10-ton crane.
1	25		Series-wound motor operating a Bedford Foundry & Machine Company 15-ton crane.

Stone-Quarry and Gravel-Pit Data—Sheet No. 2.

Stone Crusher Plant, located in Pennsylvania. Name withheld by request. Group and individual drive. Running hours per week, 60.

Total connected horsepower, 217; number of motors installed, 5; average kilowatt-hours per month, 3,371. Load-factor, 3 per cent; operating-time load-factor, 6 per cent.

Kilowatt-hour consumption per month for 8 months: October, 5,540; November, 4,950, December, 1,290; March, 3,590; April, 4,250; May, 2,620; June, 2,670; July, 2,060.

The energy consumption per ton of rock crushed is 0.34 kilowatt-hour.

MOTOR INSTALLATION

The following is a list of the motors installed, with their respective drives. The supply source is two-phase, 60 cycles, 220 volts, and 600 volts direct current.

No.	Horsepower	Speed R.P.M.	Application
1	75	850	Squirrel-cage motor belted to a No 6 Gates, style "K" stone crusher
1	100	850	Squirrel-cage motor belted to a 12.25-inch by 18.25-inch by 12-inch stroke, Ingersoll-Rand air compressor, running at 180 revolutions per minute and supplying air at 90 pounds pressure to the drills.
1	10	690	Belted to a 10-foot two-hanger line shaft driving one 12-foot by 3-foot revolving screen, running at 19 revolutions per minute and one 16-inch by 10-inch by 8-inch bucket elevator, 50 feet high.
2	16	...	Series-wound motors operating a 10-ton Baldwin-Westinghouse locomotive used to haul five empty cars weighing one ton each up a two-mile five-per-cent grade.

Butler Brothers, Randolph, Minn. Gravel. Individual drive. Running hours per week, 60.

Total connected horsepower, 300; total number of motors installed, 6; average kilowatt-hours per month, 19,450; average kilowatt-hours per month per connected horsepower, 64

Load-factor, 14 per cent; operating-time load-factor, 25 per cent.

Kilowatt-hour consumption per month for four months: July ,20,500; August, 19,300; September, 22,500, October, 15,500.

MOTOR INSTALLATION

The following is a list of the motors installed, with their respective drives. All motors are three-phase, 60-cycle, 220-volt machines.

No.	Horsepower	Application
1	75	Belted to belt conveyor.
1	20	Belted to belt conveyor.
1	25	Belted to belt conveyor.
1	100	Direct-connected to one seven-inch rotary pump with 12-inch suction; used for pumping water from pits.
1	75	Belted to No. 5 gravel crusher made by Austin Manufacturing Company.
1	3	Belted to line shaft driving one drill press; one 12-inch lathe, one emery wheel and one hack saw.

Energy for this installation is supplied by the Consumers Power Company

Stone Crushing plant. Name withheld. This plant quarries and crushes stone of two kinds, a soft grade of cement rock, and buckwheat stone containing considerable lime. The quarrying is done mostly by hand. Horse cars are employed to convey stone from the quarry to the crushers. There are 40 men employed, working 10 hours per day. Group drive.

The maximum capacity of this plant is 6,000 tons per month; average output, 4,000 tons.

Total connected horsepower, 67.5; total number of motors installed, 4; average kilowatt-hours per month, 3,311.

Load-factor, 7.7 per cent; operating-time load-factor, 28.8 per cent.

The electrical energy consumption per ton of stone crushed is 0.75 kilowatt-hours.

Kilowatt-hours for 10 months: April, 1,020; May, 3,120; June, 4,380; July, 3,690; August, 5,370; September, 3,420; October, 3,930; November, 5,010; December, 660; January, 2,520.

MOTOR INSTALLATION

The following is a list of the motors installed at this plant with their respective drives. All motors are of the squirrel-cage induction type.

No.	Horsepower	Speed R.P.M.	Application
1	40	1,140	Belted to a Power & Mining Machinery Company No. 4 McCully gyratory crusher, capacity 20 to 40 tons per hour Pulley 28 by 12 inches. From driving shaft of above machine a belt runs to a drum mechanism which draws a 700-pound car up a 100-foot incline, five-per-cent grade Maximum load of car, 2,400 pounds; average load, 1,200 pounds.
1	15	1,120	Belted to a three-hanger shaft and a two-hanger countershaft, latter bevel-geared to lower end of a revolving screen, 15 feet long by 2 feet 4 inches diameter. Revolves at 32 revolutions per minute. Geared from above three-hanger shaft is a 12-inch bucket elevator, 65-foot lift.
1	5	1,130	Belted to a short shaft driving a 20-inch horizontal belt conveyor about 35 feet long. Belt designed to move in either direction.
1	7.5	1,140	Belted to a two-hanger shaft then geared to driving shaft at top of a 14-inch belt conveyor, having a 30-degree rise for 75 feet.

Stove Manufacturing Data—Sheet No. 1.

The term load-factor is used in these data in such a sense that a load-factor of 100 per cent represents the use for 24 hours every day of power corresponding to the rated capacity of the motors connected. An operating-time load-factor of 100 per cent represents the use of the rated capacity of the motors for the running hours per day specified for each installation.

Bridgeford & Company, Louisville, Ky. This plant manufactures the "Economist" brand of stoves and ranges.

Total connected horsepower, 139.5. Number of motors, 31. Average kilowatt-hours per month, 5,698.

Kilowatt-hour consumption for 9 months: March, 6,630; April, 5,428; May, 6,000; June, 5,987; July, 5,563; August, 4,618; September, 5,104; October, 5,600; November, 6,352. Load-factor, 7.5 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is two-phase, 60 cycles, 220 volts. All motors are of the squirrel-cage induction type.

No.	Horse-power.	Speed R. P. M.	Application.
1	7.5	1,200	Belted to line shafting driving three tumbling mills.
1	0.5	1,800	Direct-connected to centrifugal pump.
1	10	1,200	Belted direct to one large tumbling mill.
1	20	1,200	Connected by silent chain to one Connersville No. 5 cupola blower, speed 190 revolutions per minute.
1	3	1,800	Belted direct to a double-emery wheel.
1	3	1,200	Belted direct to shear.
1	3	1,800	Belted to a countershaft driving elevator.
4	3	1,800	Each belted direct to a double emery wheel, 12-inch diameter.
1	2	1,800	Belted direct to single emery wheel.
1	1	1,800	Belted to jack shaft driving machine lathe.
2	0.5	1,800	Each belted direct to a small machine lathe.
1	0.5	1,800	Belted direct to small drill press.
1	1	1,200	Belted direct to punch press.
1	5	1,200	Belted to line shaft driving two punch presses; and one cutter.
1	1	1,800	Belted to a line shaft driving two drill presses.
3	3	1,800	Each belted direct to a double 12-inch emery wheel.
1	3	1,800	Belted direct to a circular wood saw.
1	2	1,800	Belted direct to a scroll saw.
1	5	1,800	Belted to a line shaft driving a 12-inch double emery wheel, and one drill press.
1	3	1,800	Belted direct to one American Blower Company No. 6 blower.
1	20	1,200	Belted to a line shaft driving seven double buffers, 12 inch diameter; and one American Blower Company No. 6 blower.
1	10	1,200	Belted direct to plating dynamo, speed, 650 revolutions per minute.
1	10	1,800	Belted to line shaft driving punch presses.
1	5	1,800	Belted direct to exhaust fan.
1	3	1,800	Belted direct to tumbling mill.

Fisher-Leaf Company, Louisville, Ky. This plant manufactures a line of high-grade stoves and ranges the average daily output being 70 stoves per 10-hour day.

Total connected horsepower, 97. Number of motors, 19. Average kilowatt-hours per month, 2,832.

Kilowatt-hour consumption for 12 months: October, 3,210; November, 3,590; December, 3,650; January, 2,260; February, 3,280; March, 3,640; April, 3,030; May, 2,300; June, 2,300; July, 1,970; August, 2,120; September, 2,640. Load-factor, 5.3 per cent; operating-time load-factor, 12 per cent

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is two-phase, 60 cycles, 220 volts.

No.	Horse-power.	Speed R. P. M.	Application.
1	5	1,760	Belted to a 16-foot line shaft, driving one 8-inch forge blower; one double emery wheel; two small lathes and one hacksaw.
1	5	1,760	Belted direct to a plating dynamo.
2	3	1,760	Each belted direct to a 14-inch buffing wheel, speed 2,200 revolutions per minute.
1	3	1,760	Belted direct to a 12-inch double emery wheel, speed 1,450 revolutions per minute.
2	3	1,760	Each belted direct to a 12-inch double emery wheel, speed 1,200 revolutions per minute.
2	5	1,760	Each belted direct to a 14-inch double emery wheel, speed 1,400 revolutions per minute.
1	3	1,760	Belted direct to drill press.
1	5	1,760	Belted direct to 12-inch double emery wheel, speed 1,250 revolutions per minute.
1	3	1,760	Belted to an eight-foot, two-hanger line shaft, driving one 1,200-pound capacity freight elevator; and one 10-inch emery wheel, speed 1,000 revolutions per minute.
1	5	1,760	Belted direct to 12-inch double emery wheel, speed 1,200 revolutions per minute.
1	5	1,760	Belted direct to 16-inch exhaust fan, speed 2,100 revolutions per minute.
1	10	1,760	Belted direct to double polishing lathe, speed 1,800 revolutions per minute.
1	5	1,400	Belted to 10-foot shaft, driving two 4 by 6-foot and two 5 by 4-foot tumbling mills, speed 150 revolutions per minute; and one 12-inch fan, speed 2,200 revolutions per minute.
1	5	Varyin	Direct-connected to mechanism of 1,200-pound freight elevator.
1	20	1,160	Geared direct to one No. 4 Buffalo blower, speed 800 revolutions per minute.
1	5	1,760	Belted direct to 14-inch saw.

Stove Manufacturing Data—Sheet No. 2.

Mobile Stove Works, Mobile, Alabama. Running hours per week varies.

Total connected horsepower, 60. Number of motors, 2. Average kilowatt-hours per month, 3,295.

Kilowatt-hour consumption for 12 months: January 4,750; February, 2,440; March, 3,130; April, 3,220; May, 3,170; June, 3,100; July, 2,830; August, 2,750; September, 2,670; October, 4,700; November, 3,750; December, 3,030.

Load-factor, 12 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts.

No.	Horse-power.	Speed R. P. M.	Application.
1	40	1,200	Belted to line shaft, driving two vertical boring mills; one radial drill; six small lathes; one shaper; one key seater; one planer; one Universal grinder; two 10-inch emery grinders; one vertical drill; one drilling and tapping machine and one hacksaw.
1	20	1,200	Belted to line shaft, driving one 36-inch cupola blower; three tumbling mills: one emery wheel; and one sand mill.

Energy is supplied by the Mobile Electric Company.

Malleable-steel stove plant, the principal operations in which are punch and press work, grinding and assembling. There are 200 men employed, working 10 hours per day. The average daily output is 90 stoves.

Total connected horsepower, 150. Number of motors, 10. Average kilowatt-hours per month, 12,100.

Kilowatt-hour consumption for 12 months: October, 12,408; November, 11,143; December, 12,577; January, 11,945; February 12,312; March, 14,068; April, 12,883; May, 2,905; June 14,060; July, 15,384; August, 13,926; September, 11,595.

Load-factor, 14 per cent.

The electrical energy consumption per stove is 5.37 kilowatt-hours.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts. Motors, except where indicated, are of the squirrel-cage induction type.

No.	Horse-power.	Speed R. P. M.	Application.
1	10	1,120	Belted to 90-foot shaft, driving one Smith & Mills eight-inch shaper, one 12-inch engine lathe; one 24 by 24-inch planer; one eight-inch emery wheel; one 16-inch drill; one 12-inch hacksaw; one Toledo No. 77 press; one No. 17 press; one No. 6 press; one Toledo No. 94-C punch; and one Excellsior 36-inch shear.
1	30	1,120	Belted to a 35-foot shaft, driving one 36-inch exhaust fan; one 12-inch double emery wheel; and one automatic grinder having eight 12-inch emery wheels.
1	10	1,120	Belted to 30-foot shaft, driving one 10-inch buffing wheel; two 12-inch emery wheels; and one 12-inch double emery wheel.
1	20	1,120	Belted to 60-foot shaft, driving six 12-inch double emery wheels; one Toledo 1,000-pound drop-hammer; one 12-inch emery wheel; and one 24-inch by 42-inch tumbling mill.
1	15	1,120	Belted direct to a 7.5-kilowatt, six-volt, electro-plating generator.
1	20	1,120	Belted to a 50-foot shaft, driving one double 55-inch exhaust fan; and six double emery wheels.
1	10	1,120	Belted to a 70-foot shaft, driving one 12-in. double emery wheel; one sheet-metal bending roll; one 2,000-pound freight elevator, and one one-eighth-inch rivet-making machine.
1	5	1,120	Belted to a 40-foot shaft, driving one 12-inch cutoff saw; and one 2,000-pound freight elevator.
2	15	840	Slip-ring motors, each direct-connected to drum mechanism of a Reedy 4,000-pound elevator.

The Graff-Webb Company, Louisville, Ky. This plant manufactures a complete line of cookstoves and heaters, about 22,000 pounds of metal being worked per ten-hour day.

Total connected horsepower, 80. Number of motors, 7. Average kilowatt-hours per month, 7,275.

Kilowatt-hour consumption for 13 months: October, 4,970; November, 6,090; December, 5,580; January, 6,180; February, 5,950; March, 5,800; April, 6,170; May, 7,320; June, 7,900; July, 9,600; August, 7,810; September, 13,940.

Load-factor, 16 per cent; operating time load-factor, 37 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with the respective drives. The supply source is three-phase, 60 cycles, 220 volts.

No.	Horse-power.	Speed R. P. M.	Application.
1	5	1,800	Belted to countershaft of cinder mill, two feet, six inches in diameter by two feet, six inches long.
1	10	1,200	Belted to 50-foot, seven-hanger shaft, and 9-foot countershaft driving one freight elevator; five 14-inch double emery wheels; and one drill press.
1	10	1,200	Belted to 20-foot, five-hanger shaft; driving five 14-inch polishing wheels; and one 14-inch buffing wheel.
1	15	1,200	Belted to line shaft, driving seven tumbling mills. three 34-inches in diameter, two 30 inches, and two 24 inches.
1	5	1,800	Belted to line shaft, driving one 600-ampere electro-plating dynamo; and one 14-inch emery wheel.
1	5	1,800	Belted direct to one 2,000-pound freight elevator.
1	30	1,800	Direct connected to one No. 8 Sturtevant 48-inch cupola blower.